ELECTRICAL REVIEW

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Electric Light and the Mafia.

The recent killing of Chief of Police Hennessy, of New Orleans, by the Mafia, and the lynching of the supposed murderers by a mob, is fresh in the mind of the public. And now the electric light seems destined to play a prominent part in the investigation, which the affair is undergoing at the hands of the Grand Jury.

The New Orleans *Picayune*, on March 25, printed an article in support of a charge that the records of the Louisiana Electric Light Company were doctored in order to make it appear on the trial of the Italians that the light at the corner of Basin and Gired streets was burning dimly at the time Hennessy was killed by the alleged Mafia.

The employé of the company who kept the records says unknown persons tampered with them and changed them to show that the lights were poor between certain hours. This employé and two others were summoned by the defence, but were not put on the stand. A subpœna *duces tecum* was issued for the records, but for some reason unknown the books were not offered.

An Electric Pinnace.

There was launched from the works of Messrs. Woodhouse and Rawson, at Chiswick, England, a new type of vessel recently. This vessel, the "Electric," is a wooden pinnace, built for the Royal Engineers, to carry soldiers from Chatham to Sheerness and back. She is 38 feet 6 inches long over all by 8 feet 9 inches beam. Her mean draught is 2 feet 3 inches, with all machinery in position and 40 persons on board. The hull is built of mahogany and is unpainted. The motive power is electrical, the following being stated to be the particulars of the machinery and performance: There are 70 accumulators of the E. P. S. type, having 19 plates each. They have a discharging current of 1 to 40 amperes and 120 ampere-hours. The power is transmitted from the accumulators to a motor discharging 32 amperes at full power, the propeller rotating at 800 revolutions. The propeller is 22 inches in diameter, and is of Delta metal. The maximum brake horse-power is 5¼; this is said to give a mean speed through the water of 8¼ miles per hour. The motor is a single magnet machine, designed specially for marine propulsion. The boat will run from 8 to 12 hours with one charge. The total weight of all machinery is 2½ tons, the displacement being 4¼ tons. The ease with which this vessel is worked is, of course, a notable advantage over a steam craft. There are two masts, each carrying a balance lug-sail, there being also a stay-sail forward. The sail spread is about 350 square feet. With the effective lead ballast, given by the accumulators, the boat should perform well under canvas, especially in view of the small propeller that is characteristic of electrical vessels. The balance lug is quite a new rig for service vessels, and it remains to see how far this up-river sail will suit the open reaches of the lower Medway. As the Royal Engineers have all the requisite appliances and machinery for charging the cells ready to hand, and established in any case at Gillingham, an electrical boat is especially suitable for the work of the station, and should succeed there, says *Engineering*, if it can in any position.

The "Kingdon" Inductor Dynamo.

We are indebted to *Industries* for the illustrations on this page (Figs. 1 and 2), representing one of the 70 unit alternating current dynamos designed by Mr. J. A. Kingdon for the central station at Woking. In this machine the coils, which correspond both to the armature coils and to the field magnet coils of an ordinary alternating current dynamo, are fixed, while the revolving wheel carries a number of laminated masses of iron or inductors, which produce by their motion magnetic changes in the iron cores of the armature or secondary coils. The magnets of the dynamo are built up of a number of stamped iron plates, each plate being of the shape shown in Fig. 3, and having four projecting core pieces. These plates are bolted between two stout cast-iron frames, which also carry the pedestals. The machine is divided horizontally along the center lines, so that the top can be lifted off and the wheel taken out. There are 32 magnet cores projecting from the magnet ring, and 16 of these are fitted with the primary or exciting coils, and 16 with the secondary coils in which the alternating current is generated, primary and secondary coils being placed alternately. In the diagram (Fig. 3) the poles marked N S N S are primary poles, and are magnetized by means of an exciter with the polarities indicated. The intermediate poles *n s n s* are the secondary poles, and have their magnetism constantly changed as the inductor wheel rotates. The number of inductors, which consist of a number of stamped iron plates bolted between two steel disks carried on a hub on the shaft, is 16, being equal to half the number of the magnet cores.

The action of the machine is as follows: In the position of the wheel shown in Fig. 1, the secondary poles have the polarities indicated, being magnetized by the primary poles with which they are connected through the inductors. When the inductor wheel has rotated through $\frac{1}{32}$ of a complete revolution, the secondary poles will all have their polarities changed, being now magnetically connected through the inductors, each with the primary magnet on the other side. The inductor wheel thus acts as a magnetic commutator, and as it rotates continually changes the polarities of the secondary magnets. Alternating currents are accordingly generated in the coils wound on the secondary magnets. The polarity of the secondary magnets being changed 32 times during each complete revolution, the number of alternations per revolution is 32, being equal to twice the number of the inductors, and being quite independent of the number of primary or secondary coils.

The dynamos at the Woking central station are coupled direct to triple-expansion engines running at about 260 revolutions per minute. The periodicity of the machines is therefore 70. Each machine is divided into halves, each half giving 15 amperes at 2,000 volts at the speed mentioned. Either the top half or the bottom half can be used alone or the two halves may be used together as one machine. When the load on a machine is less than 30,000 watts, one-half only of the primary magnets are excited, and current is taken from the corresponding secondaries. The principal dimensions of the machine are: Length, 6 feet 8 inches; height, 6 feet 8 inches; width, 3 feet 9 inches. The inductor wheel is 4 feet 6 inches in diameter. The inductors measure 12 inches by 8 inches on the face. The magnets are 3 inches long, and measure 12 inches by 3 inches on the face. The resistance of eight primary coils connected in series is 2.7 ohms, and of eight secondary coils 1.8 ohm. The total weight of the machines is about 7½ tons.

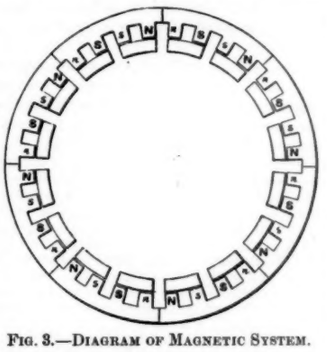
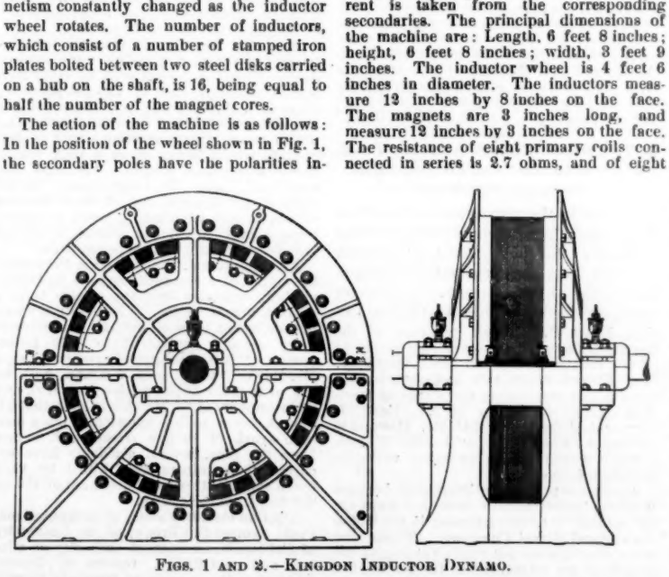


FIG. 3.—DIAGRAM OF MAGNETIC SYSTEM.



FIGS. 1 AND 2.—KINGDON INDUCTOR DYNAMO.

The Kingdon inductor dynamo is manufactured by Messrs. Woodhouse & Rawson (United), Limited, of 88 Queen Victoria street, E. C., at their heavy engineering works, at Kidsgrove, near Crewe, where also the engines and boilers for the Woking central station were made.

Copper.

The visible supply of copper in England, France and afloat thereto March 16, was 57,681 tons, a reduction of 1,350 tons for the first half of the month.

New York Board of Electrical Control.

A very turbulent meeting of the Board was held in the Mayor's office, March 25. Mayor Grant was far from being in a cheerful humor, and when he discovered that the command he issued on December 16, that all dead poles be removed within 90 days, had not been obeyed, he became huffy. Manager Brown, of the United States Company, manager May, of the Mount Morris Company, and ex-Judge Kelly, of the East River Company, laid the blame on the weather, which they said would not permit the accomplishment of this work. A list of streets in which poles that could be removed are standing was submitted by Chief Engineer Kearney.

A discussion followed, in which it was learned that the electric light wires of the East River Company were strung on the same poles as the wires of the Metropolitan Telephone Company in Thirteenth street. This was contrary to the rules of the Board providing that high and low tension wires should not be strung on the same poles.

At this point his Honor ceased being huffy only to become angry. After Mayor Grant had stormed about a bit, the Board passed an order compelling the Metropolitan Telephone Company to remove all of its poles in Thirteenth street, between First and Sixth avenues, within 24 hours.

The Mayor instructed Public Works Commissioner Gilroy to cut the poles down if this order was not obeyed. This order is sure to embarrass the subscribers to this telephone company along Fourteenth street, and a number of fire wires may also come down. So far as known the poles are supporting only one electric light wire.

The second act of the performance opened when ex-Judge Kelly became involved in a wordy altercation with Engineer Kearney, who, he said, was unduly favoring the Edison Company at the expense of its competitors. Mutual accusations and recriminations were passed to the delight of the spectators.

President Cutler, of the Metropolitan Telephone and Telegraph Company, appealed to the Mayor to rescind his order to cut down the poles on Thirteenth street, and Engineer Kearney pointed out that it would affect a number of fire and police department wires. His Honor was obdurate, and directed an adjournment to Monday afternoon of this week. Mr. Cutler said afterward that he should at once take steps to remove every electric light wire from the poles of his company throughout the city.

Lawyer Burton N. Harrison, for the telephone company, went before Judge Allen on the 26th and secured an injunction restraining Commissioner Gilroy from cutting down any poles in Thirteenth street. Lawyer Harrison said there was no subway in Thirteenth street and until one was provided the Mayor had no right to order the poles cut down.

The Telephone Subscribers' Association, of New York city, held a meeting in the rooms of the Board of Trade last week and elected officers for the ensuing year. Resolutions that the association continue its fight for lower telephone rates were adopted, and a recommendation made that a mass meeting be held in Cooper Union to agitate the subject.

THE FUTURE OF ELECTRICITY.

DISCUSSED BY THE PROPHET OF THE "ELECTRICAL REVIEW."

The man who could have bought Bell telephone stock at $10 a share and *didn't* is now becoming extinct. His favorite haunt was the smoking compartment of a Pullman car, where he was wont to repeat the oft-told tale of the grocer who *did* and got it in payment of a bad debt at that. In his place we have another specimen quite as easy to recognize.

After some of the strange tales of electrical science have been discussed, he is sure to gravely remark, as though it had never been uttered before, "Well, electricity is in its infancy" and quickly add the inevitable corollary, "but it's the coming power, though."

Just watch this man. You will be surprised to see how many there is of him. He is the Public. You must study his moods and lead him aright. The marvellous products of electrical science have so charmed his mind that no story of its newly discovered powers can be so much at variance with the laws of nature as not to be received by him with ready belief.

One of the most delicate duties which the electrical man is called upon to perform is to set aright the mind and money of some lay friend who rejoices in the possession of a secure position on a "ground floor," totally unmindful of the existence of a yawning cellar and perhaps sub-cellar beneath.

When in a moment of enthusiasm the electrician tells to unscientific ears that wherever a sun spot, millions of miles away, bursts forth into renewed splendor, all of the magnetic needles on earth are deflected, and bow, as it were, like Pharisees, in homage to the sun, he has unwittingly prepared the way for the man with the ocean telephone.

After having shown that an electric wave traveling through 96,000,000 miles of ether can actually move a needle on earth, all of his talk about electrostatics, retardation and the well known limits of cable telephony is of no avail to prove that it is not possible with a powerful transmitter and big battery to talk through an ocean cable. And straightway enough money is put forth to enable the down-trodden inventor to perfect just a "few details" of his apparatus which will bind two continents in colloquial union.

The idea that electricity may some time be had on tap, and be drawn off from the earth like natural gas or water from a spring, is firm in the popular mind and hard to dislodge, especially after you have just shown that in a dynamo the current is generated by the revolution of coils of wire before the poles of a powerful magnet. Is not the earth a great magnet and is it not revolving at a frightful rate and are there not electric currents in the earth which are sometimes strong enough to prevent the working of telegraph lines? When you consider that some of the earth currents, which accompany a display of the Aurora, have been known to bring incandescent lamps to a red heat and to be sufficiently strong to operate long telegraph lines, the argument against "electricity on tap" loses much of its force. That Franklin drew electricity from the clouds is no argument that it can be pumped from driven wells; yet, there is reason to hope that electricity may be made so cheaply as to be available for all. But, if electricity is the coming power, where is it coming from?

The cheapest method of producing electricity to day is by means of the dynamo, and as water and wind power are not generally available, it is necessary to use the steam engine, which, of course, means the consumption of coal, which thus becomes the real source of electricity. The steam engine and boiler are merely devices to convert the potential energy of the coal into mechanical power to drive the dynamo. Now, if the steam engine and boiler were perfect machines and capable of delivering at the belt of the dynamo all of the energy of the coal, the limitation of electrical power would have been reached and nothing further could be hoped for, as the generation of electricity by direct action of chemicals or by tidal power is restricted by the cost of zinc on the one hand and the obvious limitations of tide mills on the other. But the steam engine and boiler are not perfect machines. In many cases only 10 per cent. of the energy stored up in the coal is delivered by the steam engine at the dynamo. When this waste of 90 per cent. is stopped by the direct production of electricity from coal, the marvels of electricity will have only begun. Who can tell what they will be?

THE PROPHET.

Davenport, Rock Island and Moline Electric Railway.

It is expected that the electric cars (Thomson-Houston system) will be running on the Rock Island side of the river within three weeks. There is now in the power house in Rock Island enough machinery to operate a portion of the system, and things are only waiting on the completion of one of the three big tripod boilers that are to furnish steam for the engines. This boiler will be set up and in order in a few days. The work of erecting the poles and stretching the wires on the Third avenue line in Moline is progressing and will be completed in about ten days.

The car shop in Davenport, on the corner of Second and Rock Island streets, is under roof, and its inside work will be finished in two weeks, when it will be ready for occupancy. The Davenport *Democrat* says:

"There are obstacles in the way of getting the cars in motion over here, however, and we shall not ride behind the motorneer as soon as our friends in Illinois. The hitch now is in connection with the crossing of the bridge with the lines for the carrying of the potential current. The plans for this work have been made for some time, have been submitted to the Western Union Telegraph Company and accepted as being satisfactory, and now all that is wanted is the order from the war department allowing the work to be carried out as contemplated by these plans. This order, for some mysterious, red tape reason, does not come, and in the meantime things are standing still. It will take some time to put the lines across the bridge after this official permission is received. The representatives of the syndicate are not committing themselves to positive promises as to the day and hour the lines on this side of the river will begin to run by electricity, but they continue to hope that it will not be long, and our people join with them in the hope."

A. T. Rowand Retires from the Presidency of the East End Electric Light Company, Pittsburgh.

Changes in the management of the East End Electric Light Company are now being discussed. One story is that A. T. Rowand, who has been the president and largest stockholder of the company, has no longer any interest in it, and at a meeting last Friday, James H. Willock, president of the Second National Bank was elected president of the East End Electric Light Company. Mr. Willock denies this, and says he has been merely performing the duties of president during the illness of Mr. Rowand. Concerning the story that Mr. Rowand is no longer a stockholder, neither Mr. Willock nor any person else in authority will give definite information

Another report, more interesting because it affects larger interests, was that steps are being taken to restore harmony in the Union Switch and Signal Company. Those who know the facts are not ready yet to give the details of the settlement to the public, but it can be stated that the terms will be entirely satisfactory to Mr. Westinghouse and his friends.—*Pittsburgh Times.*

The Direct United States Cable Company Wins the Race.

The Direct United States Cable Company has again had the satisfaction of outdistancing all competitors in the time occupied in cabling the news of the result of the Oxford-Cambridge boat race across the Atlantic. The Direct Company has accomplished this feat so often, that it is suggested by an exchange that it would only be fair to the other cable companies that it should handicap itself by conceding them a time allowance.

The Terrible Power of Water in Motion.

[From the New York *Sun.*]

About two months ago there was a dinner party at General Schofield's house in Washington. Among the guests were President Harrison, Chief Justice Fuller, the late Secretary Windom, Speaker Reed, Senator Sherman and Senator Stanford and Mr. Justice Stephen J. Field.

During the dinner the conversation turned upon mining operations in California, and Judge Field, whose knowledge of all matters relating to the Pacific coast is as extensive as his powers of narrative are entertaining, astonished the distinguished company by some of his assertions in regard to the force of the jets of water employed in hydraulic mining. He described the wonderful manner in which the streams from the hose cut to pieces and tear down the hills that hold the precious metal. Judge Field cited the Hon. James G. Fair as his authority for the statement that under a vertical pressure of 100 or 200 feet the force of the stream is sometimes so great as to hurl away or hold boulders weighing a thousand pounds; and that it would be no more possible to cut through such a stream with a crowbar or an axe, where it issued from the nozzle, than to sever eight inches of solid iron with a penknife.

As Judge Field afterward informed Senator Fair, in a letter asking for expert testimony about the power of water applied by hydraulic machinery, these assertions were received by some of General Schofield's guests with smiles of polite incredulity. The eminent jurist felt that his position, for the moment, was somewhat like that of the Englishman who informed the King of Siam that in England water often became so hard that people could walk on it. It is not at all surprising that the facts gravely alleged by Justice Field should stagger even an imagination like the Chief Justice's, or strain the faith of so profound a believer in dynamics as the Hon. Thomas B. Reed.

In consequence of this incident, and for the vindication of his own reputation for veracity, Judge Field has collected from several of the highest authorities on practical hydraulics, evidence and opinions that are of great interest.

Ex-Senator Fair tells Justice Field that at the Spring Valley gold mine in Cherokee, Cal., the water used in the hydraulic mining operations was brought in pipes and ditches from a distance of nearly 100 miles, and that the volume of water used on every working day in that mine amounted to three times the number of gallons consumed daily by the entire city of San Francisco.

Mr. Louis Glass, for 16 years the superintendent of the Spring Valley mine, assures Justice Field that he has seen an eight-inch stream, under 311 feet of vertical pressure, move in a sluggish way a two-ton boulder at a distance of 20 feet from the nozzle; and that the same stream striking a rock of 500 pounds would throw it as a man would throw a 20 pound weight. "No man that ever lived," adds Mr. Louis Glass, "could strike a bar through one of these streams within 20 feet of discharge; and a human being struck by such a stream would be killed—pounded into a shapeless mass."

Mr. Augustus J. Bowie, of San Francisco, the author of a standard book on hydraulic mining, estimates that the stream from a six-inch nozzle, under 450 feet vertical pressure, delivers a blow of 588,735 foot pounds every second, equivalent to 1,070 horse-power. "It is absolutely impossible," says Mr. Bowie, "to cut such a stream with an axe, or to make an impression on it with any other implement." Mr. Bowie adds that although never to his knowledge has a man been struck by such a stream as it comes from the pipe, several accidents have occurred where miners were killed by very much smaller streams at distances of 150 or 200 feet from the nozzle.

After an elaborate series of computations, Prof. Samuel B. Christy, of the University of California, an eminent authority on mining and metallurgy, reports to Justice Field that if a nozzle of from six to nine inches diameter were specially arranged to throw a stream vertically upward against a spherical boulder of quartz weighing 1,000 pounds, the vertical head being anywhere from 100 to 500 feet, the boulder would be forced up until the diminished velocity of the stream established an equilibrium of pressures. There would be a point at which the upward pressure of the stream would exactly balance the gravity pressure of the boulder, holding it, the half-ton rock, there suspended. In practice, of course, the boulder could not be balanced accurately upon the axis of the stream, but would fall to one side or the other. But if a large conical basket of iron bars were arranged about the nozzle so as to catch the boulder whenever it should be deflected from the stream, and return it to the nozzle, the 1,000 pounds of quartz would be kept in play like a ball in a fountain. As to cutting these streams, Prof. Christy says that he has often tried to drive a crowbar into one of them. The stream felt as solid as a bar of iron, and, although he could feel the point of the crowbar enter the water for perhaps half an inch, the bar was thrown forward with such force that it was almost impossible to retain it in the grasp. An axe swung by the most powerful man alive could not penetrate the stream; yet it might be cut by the finger of a child, if the child were seated on a railway train moving parallel with the stream in the same direction and with the same velocity. That velocity would be considerably more than a mile a minute.

Justice Bradley, of the Supreme Court, has also tried his intellect upon the mathematics of the problem submitted by Judge Field. He delivers this opinion: "I can well believe all you say with regard to the tremendous force of streams issuing from the pipes of the miners under a large head of water. Of course, they would produce instant death if directed against a man standing near, and would probably cut his body in two."

The statements here presented in summary will not astonish engineering experts or members of the New York fire department. The average citizen, however, is accustomed to regard water as the least destructive liquid that can be put in motion, and he is familiar with no stronger manifestation of its power than the velvety touch of the stream from the Croton faucet.

We should say that the distinguished Californian upon the bench of the Supreme Court had amply vindicated his right to be heard with respect and perfect confidence by any dinner party on the subject of hydraulic pressure. Does it occur to General Schofield that in these facts there is the suggestion of a novel and most terrible engine of military defense against assaults at short range?

MONTREAL ELECTRICAL NEWS.

Mr. Albert J. Corriveau recently returned to Montreal from this city where he made quite a visit in connection with the meeting of the National Electric Light Association to be held in Montreal next August. Mr. Corriveau is devoting a great deal of his time and attention to this matter and is stirring up a great deal of enthusiasm in Montreal.

The next meeting promises to be a brilliant success. The electrical exhibition will be one of the main features of the gathering. It will last throughout the whole week, and will consist of a collection of all the latest electrical apparatus. The Quebec and Levis Electric Light Company has already invited the Association to visit Quebec at the conclusion of the Convention to inspect the plant, whose motive power is the Montmorenci Falls, and whose circuit extends over 34 miles. A *fête* is to be arranged for the close of the Convention.

Mr. Corriveau has received the following letter from Sir Wm. Dawson, president of McGill University:

MONTREAL, March 17, 1891.

DEAR SIR: Having learned that the National Electric Light Association proposes to meet in Montreal in August next, I beg to state that the McGill University will have much pleasure in opening its museum and library to the members of the Association while in the city. I regret that our new technical and physics building will not be completed in time for the meeting, but sufficient progress will be made to indicate what it will be when finished.

I have the honor to be,

Yours truly,

J. WILLIAM DAWSON.

A meeting will be called in Montreal in a few days to decide what steps shall be taken in regard to forming a citizens' reception committee.

The Electricity in Colors.

It is reported that an Englishman put on a pair of woolen stockings over his silk ones on a cold winter day, and at night he pulled the stockings off without separating them and was astonished by the crackling noise and even the sparks of electricity which followed. When he drew the silk stockings out of the woolen ones, the electrical attraction was so manifest that the stockings would incline toward one another when held some distance apart. It happened that the silk stockings were black and the woolen ones of light color, but when he tried the experiment with both stockings of the same color there was no electrical manifestation.

Electro-Magnetic Repulsion.

ABSTRACT OF A LECTURE AT THE ROYAL INSTITUTION OF GREAT BRITAIN, BY PROF. J. A. FLEMING.

Holding a circular coil traversed by a continuous electric current near to a similar circuit free to move, we are well aware that when the circuits are parallel to each other there is an attractive force between them, if the currents in the adjacent parts of the circuits flow in the same direction and a repulsive effect if they flow in the opposite. This is the electro dynamic action discovered by Ampere. If one such conducting coil, such as that in an electro-magnet, is traversed by an alternating current, and the other is simply a closed circuit or coil placed a little distance off, but in its field, the close circuit becomes the seat of an alternating induced current, which can be made to render itself evident, if the inducing current is sufficiently powerful, by illuminating an incandescent lamp in the secondary circuit. The secondary circuit must, however, be so placed that the magnetic lines of force of the primary coil perforate through the secondary circuit.

If the secondary circuit is held in such a position that the reversal of direction of the primary current causes no reversal of direction of the magnetic field traversing the secondary circuit, the secondary circuit is no longer the seat of any induced current, because it is not linked with any of the lines of the primary. This electro-magnetic induction taking place across space, is not interfered with by the interposition of a non-conducting screen. The magnetic induction passes freely through an inch board or a plate glass, but if we interpose a thick copper sheet, we cut off the secondary current or screen the secondary circuit from the inductive action of the primary. The secondary coil is, in fact, an electro-magnetic eye which can *see through* an inch of wood, but to which a sheet of zinc is semi-transparent and a thick sheet of copper is quite opaque. The rapid heating of this sheet of copper makes us aware that currents are now induced in the copper sheet in the form of eddy currents, and it screens the secondary circuit, because the inductive action of these eddy currents on the side remote from the magnet is exactly equal and opposite to that of the primary circuit on the secondary coil. This circumstance explains another fact. If a continuous current is used to magnetize an iron core very powerfully, it will be found to be impossible to strike the pole of the magnet a sharp blow by means of a sheet of copper. Holding the sheet of copper over such pole and energizing the magnet, the hand holding the copper feels a repulsive action the moment the circuit is closed and the attractive action when current is cut off. If we try to slap the magnet sharply with the copper sheet, the repulsive force dampens the blow. A disk of copper let fall upon the pole of a magnet does not fall down sharply and quickly, but settles softly and slowly as if falling through some sticky fluid. The correct explanation of this is that the motion of the conductor toward the magnetic pole causes eddy currents to be generated in it by electro-magnetic induction, which currents being opposite in direction to the energizing current of the magnet, cause repulsive force between the inducing and secondary circuits which creates the apparent resistance we feel.

If we balance a small disk of copper the size of a penny over the pole of a powerful electro magnet and attach a mirror to one end of a bar attached to the penny, the movements can be readily seen by the reflection of a ray of light upon a screen; on magnetizing the magnet the copper is repelled, and on demagnetizing it, it is attracted. If you take a copper ring and hold it vertically over the pole of an alternating electro-magnet, it will jump into the air if released impelled by electro-magnetic repulsion. Rings of copper and aluminium are the most nimble for this purpose; rings of zinc and brass are sluggish, and a ring of lead will not jump at all.

If an incandescent lamp be connected in shunt relation to an electro-magnet and the divided current is just sufficient to faintly illuminate the lamp, when you break the circuit the lamp will flash up for a moment, by reason of the electro-magnetic momentum of the coil, by virtue of which the current continues to flow on in the coil for a short period after the impressed electromotive force is withdrawn. Also, there is a small but definite time required before the current practically reaches its full strength when the circuit is closed. These are the effects of self-induction which cause the current to lag behind the inducing electromotive force. The effect of relative conductivity of metals may be shown by weighing similar disks of different metals over an alternating pole. The greater the conductivity the greater the repulsive force, and, therefore, the lighter the weight of the disk placed in the scale over the pole.

FIG. 1.—INCANDESCENT LAMP AND ELECTRO-MAGNET.

If you take a paper tube and hold it over an alternating pole and let a copper ring drop in the tube, it falls as if on an invisible cushion and finally reaches a point where it remains floating in the air. If rings of different metals and the same size are placed in the tube, they float at different levels. If two such rings are pressed together while being repelled from the pole, they attract one another, a copper ring supporting a zinc. If the ring or disk be cut so as to hinder circulation of the induced current, the repulsive effect vanishes. A ring of copper which was able to jump from the pole after being cut yielded no signs of life. When the rings are of very good conductivity the effects are quite strong. A massive copper ring weighing eight or ten pounds can be made to float in the air. Such a ring is illustrated in the accompanying engraving,

FIG. 2.—METAL RING AND ELECTRO-MAGNET.

where the ring is chained to a desk or table by four light strings and is repelled by the electro-magnet through which an alternating current passes, so that it floats in the air and holds the strings tense.

A beautiful experiment due to Professor Elihu Thomson, exhibits the effect of electro-magnetic repulsion on a closed coil. This is illustrated in the accompanying engraving, wherein a closed coil is placed in circuit with a small incandescent lamp and placed in a vessel of water over an alternating pole. The electro-magnetic induction creates a current in the coil which lights the lamp, and electro-magnetic repulsion on the coil causes the lamp and coil to raise upwardly in the water.

LITERARY.

"Journal of the Franklin Institute" for March, 1891, has been received.

The Century for April contains a wealth of good pictures, fiction and serial stories.

"Proceedings of the United States Naval Institute," Volume XVII, has been received.

In connection with the series of articles on ocean steamships begun in the April number of *Scribner's Magazine*, Chas. Scribner's Sons have issued an artistic little folder, called "Twenty Questions about Steamships."

Mr. Albert J. Corriveau, of Montreal, has sent us a beautifully prepared book, called "Montreal." It is published by J. McConniff, ticket agent, Windsor Hotel, Montreal, and contains a profusion of historical notes and handsome half-tint engravings of the places of interest in Jacques Cartier's city.

"The Simplex Manual of Valuable Tables and Formulæ," is the title of a handy book issued by the Simplex Electrical Company, 620 Atlantic avenue, Boston. It is designed for the use of electrical engineers, and gives, in addition to the tables, much information about the Simplex wires and cables. People in all parts of the world have sent requests for this book, necessitating the publishing of a new edition, the one at hand, to which many important additions have been made.

Miss Sara Jeannette Duncan, the author of "A Social Departure," has written a new book portraying the strange and humorous experiences of an American girl in London. Few writers of recent years have obtained such rapid and remarkable success as that which followed upon the appearance of "A Social Departure," and a new book by this brilliant author will be read with lively interest. The book has been cleverly illustrated by Mr. F. H. Townsend, and is published by D. Appleton & Company, New York.

Scribner's Magazine for April marks the beginning of the richly illustrated series on "Ocean Steamships," which, it is believed, will be as successful as the "Railway" and "Electric" series. The most competent authorities have been chosen to write of "Ocean Passenger Travel," "The Ship's Company," "Safety at Sea," "Speed," and the "Lines of the World." Original drawings by skillful artists (who have been granted special privileges for study by the various steamship companies) will illustrate each paper.

In a little seven-by-nine room, in one of the upper stories of the old New York *Tribune* building, many years ago, I frequently saw a man with a very round bald head and a fringe of nearly white hair under his chin. He sat at a desk which was almost on a level with his shoulders. He was somewhat careless in his dress, and being very near sighted, he leaned down upon the desk, describing almost the segment of a circle in the lines as he wrote. This was Horace Greeley, the founder and chief editor of the *Tribune*.—*April St. Nicholas.*

In view of the approaching centennial of the founding of the patent system in Washington, James Shepard's article, "The United States Patent System," in the *New England Magazine*, for April, is especially pertinent. Mr. Shepard is widely known as a patent expert, and his article sheds light upon many of the knotty points which make our patent laws such a mystery. The article urges, with special strenuousness, the crying necessity of extending the existing facilities of the patent office and enlarging the staff of this much overburdened department.

The life and labors of the inventor are truly portrayed in a highly imaginative and absorbing story called "The Diamond Lens." The author is Fitz James O'Brien, now dead and nearly forgotten, but who was in his day one of the brilliant stars in the firmament of New York literary circles. O'Brien's hero is an enthusiastic microscopist, but his remarks on his own work are equally applicable to a searcher after truth in any other field of science. In one place he says: "Like all other microscopists, I gave my imagination full play. Indeed, it is a complaint against many such, that they supply the defects of their instruments with the creations of their brains."

Kittery, Me.—Vulcan Electric Company; capital, $100,000.

Sumter, S. C.—The Sumter Telephone Company; capital, $2,000.

Sheldon, Ia.—The Sheldon Electric Light Company; capital, $20,000.

Oconto, Wis.—Citizens' Light and Fuel Company; capital, $25,000.

Monterey, Cal.—The Light and Development Company; capital, $25,000.

Chicago, Ill.—Halson Electric Harness and Supply Company; capital, $250,000.

Monmouth, Ill.—The Monmouth Motor Street Railway Company; capital, $30,000.

Riverside, Ohio.—The Riverside Electric Street Railway Company; capital, $50,000.

Ashland, Ohio.—The Ashland Gas and Electric Light Company; capital, $50,000.

Tacoma, Wash.—The Commercial Electric Light and Power Company; capital, $250,000.

Denver, Colo.—The Gouyard Electric Company, to operate the Gouyard magnetic process for the treatment of ores; capital, $100,000.

Portland, Ore.—The Waverly-Woodstock Electric Company; capital, $110,000. The directors are J. W. Campbell, C. F. Swigert and W. C. de Celle.

Mayville, N. Y.—The Electric Light and Power Company, of Mayville, N. Y.; capital, $1,000. Incorporators, Lewis Bixby, H. S. Bixby and W. H. Tennant.

Bartow, Fla.—The South Florida Telephone Company; capital, $5,000. The officers are: President, W. D. Taylor; secretary, Frank Clark; treasurer, C. J. Seegar, and these three constitute the first board of directors.

Cleveland, O.—A company has been organized, with $50,000 capital, to manufacture trolley protectors and friction brakes for street cars. The principal stockholders are E. C. Caleyron, M. A. Yeakley, P. J. Hotaling and R. A. Robertson.

Greenbush, N. Y.—The Electric Manufacturing and Gas Engine Company; capital, $75,000. The trustees are: Edward N. McKinney, Albany; George H. Ennis, Troy; Robert J. Pratt and James Hyde Pratt, East Greenbush, and Arthur Rollanson, England.

Ogden, Utah.—The Ogden City Street Railway Company; capital, $250,000. The incorporators are: H. M. Beardsley, with 2,496 shares, and R. L. Rhodes, H. C. Gilbert, C. H. Nicolet and Alfred Gregory. The same gentlemen form the board of directors, but no organization has yet been effected.

Interesting Comments on an Electric Road.

Some progressive people in Biddeford, Me., are advocating the building of an electric railroad between that place and Saco. An opposition party has arisen. A reporter for the Biddeford *Standard* interviewed men on the subject. Here are three of the answers he received to the question, "Are yez wid us or agin us?"

"Herbert Jordan—It would frighten horses the first year, and the city would have to pay a good deal of money for damages. No horses around here are accustomed to cars run by electricity."

"John Banks—I favor electricity, but even that will not pay. There is a certain class of people in both cities who, to save express money, will carry their trunks on their backs."

"C. A. Dumas—I want the road to be run by electricity, because if it is, I shall have an electric cash system introduced into my store and have my office moved upstairs."

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EDITORS:
GEO. WORTHINGTON. CHAS. W. PRICE.
ASSOCIATE EDITORS:
ROBT. H. READ. STEPHEN L. COLES.

BUSINESS STAFF:
GEO. WORTHINGTON, President. CHAS. W. PRICE, Secretary.
ROBT. H. READ, Manager Patent Bureau.
H. T. RICHARDS. Mgr. Advertising Department.

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EUROPEAN OFFICE:
CHARLES FFRENCH, Editor for Europe.
HOTEL VICTORIA,
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The utterances of our "Prophet" will interest and edify every reader. Watch them.

What a great showing the progressive and restless electrical inventor presents in this issue!

Electrical interests in New York, to the shame of this great city be it said, have a hard fight for existence.

The electric car, in its onward march of progress, is driving before it a constantly increasing herd of emancipated car horses. It is said that there are 600 ex-car horses for sale in Toledo, O.

Mr. John Jacob Astor, whose recent marriage was so widely noticed in the press of the country, is an earnest student of electrical science, and has been for years an interested reader of the REVIEW.

Excavating for a cable road on Broadway, this city, has commenced, yet we venture the prediction that the cable will soon be distanced by electricity and that it will be adopted on the Broadway line.

The man with a perpetual motion machine and the man with a primary battery that would supplant the dynamo are two individuals that are just now enjoying a well-earned vacation. But we suspect they will return to this fascinating work at an early day.

No writer for the daily press takes more interest in electrical work than Joseph Howard, Jr. Mr. George Alfred Townsend is another able writer who appreciates the rapidly extending importance of this new industry.

The "infancy of electricity" is nowhere more apparent than in the field of literature. How many novels or stories can you count in which electricity plays a leading part? Frank R. Stockton has written one story and Ballou a novel.

The inventors from all over this great country are expected to visit Washington next week. The REVIEW hopes to see the Inventors' Congress a pronounced success, and congratulates its promotors on the interest they have evoked.

We hope to see the electrical industry overtop all others at the World's Columbian Exposition in 1893. John P. Barrett, the eyes of the entire fraternity are watching you! We predict that you will win, and the REVIEW will constantly aid in every way in its power.

The remarks of "The Prophet," on another page, are interesting and meaty. This writer is evidently a philosopher and scientist, and his column, which will appear regularly in the REVIEW hereafter, will undoubtedly attract attention, and deserve careful perusal by all persons interested in electrical progress.

Never in the history of this journal has it been in receipt of as many requests for specimen copies as at present, nor has its circulation ever increased so rapidly as during the past two months. This is not alone a tribute to the value and popularity of the REVIEW, but is an emphatic evidence of the growing interest in electricity.

HIGH FREQUENCY OF ALTERNATING CURRENTS.

A very interesting discussion from the pen of Mr. Charles Steinmetz upon the results in lighting pointed out by Mr. Tesla and Professor Thomson when currents of very high frequency of alternation are operated with, is presented in this issue of the REVIEW. Mr. Steinmetz's remarks deserve very careful consideration. In view of the limited scope of the work and the striking character of the phenomena, it would be premature now to hazard anything more than a speculative explanation. Whether the incandescence of a filament disconnected from the secondary circuit and simply held near an induction coil traversed by a current of high frequency be due to a condenser effect, to current leakage, or to electro-magnetic induction, is a question of high interest not yet conclusively answered.

Regarding a filament as a simple conducting loop, the molecular agitation when it is cut 33,000 times per second by a magnetic field of force must naturally develop great heat. According to Mr. Tesla the glass bulb heats also, and we are led to infer that the heating is not due to calorific radiation from the filament. Under the lively dance of the lines of force, perhaps, even glass becomes responsive to the reversal of the field of force. Mr. Steinmetz is of the opinion that for practical uses the tendency must eventually be toward a lower frequency of reversal rather than toward a higher frequency, basing his conclusion upon the increasing importance of hysteresis and self-induction as the frequency increases. Perhaps these obstacles will prove of less importance in lighting than in motor work. Self-induction will create a lag of the current behind the impressed electromotive force, but the time length of the waves from zero to zero will remain the same, and when the secondary is at work it might be expected that there would be less magnetization of the iron and a more direct transference of energy from primary to secondary. Doubtless the able electricians who have begun the work will follow it to its ultimate conclusion, and as hindsight is far more reliable than foresight, the highly interesting phenomena will doubtless be more accurately classified at a later stage of the investigation.

THE SUCCESSFUL NEWSPAPER MAN.

This individual was quite ably discussed in *Truth* last week. Blakely Hall, the new editor of this journal and a successful and entertaining writer with every promise of being a successful editor, reviews the daily newspaper situation in New York in words of sense and point. Here they are:

"To obtain an absolutely impregnable position in New York journalism a paper must secure in the first place a man of more powerful personality and impressive genius than Charles A. Dana; an organizer and creator of greater fecundity and force than Joseph Pulitzer; an editor of keener political acumen than Whitelaw Reid, and a man of more cosmopolitan tastes and restless energy than James Gordon Bennett, to catch the eyes of the multitude. Men worship men. After a great editor has been secured it will be necessary to make the new paper more attractive typographically than the New York *Recorder;* more convenient than the *Continent;* more newsy than the *World;* as carefully written and attractively made up as the *Sun*, and it must have a general telegraphic news system which will reach further and do better work than the elaborately perfected system of the *Herald.* This is about the field as it stands to-day, and the new-comer needs courage, pluck—and a great editor.

"It is asserted, apparently on substantial authority, that the son of the late Senator Hearst has been negotiating, for a few weeks past, with one of the most prominent news agencies in New York, with the settled purpose of starting another daily paper here. Young Mr. Hearst is tall and of spare physique, with light hair and mustache, blue eyes, and a quiet and retiring manner. He is liberally discussed here and elsewhere as a son of $30,000,000 is apt to be. A good deal of the criticism directed against the late Senator Hearst's son borders on the abusive, and yet it is difficult to see why it should. He is a journalist of practical and recognized force, and the remarkable success which followed him in his San Francisco venture should stamp him as one of the few men who deserve to rank as of importance among newspaper projectors. He has made the *Examiner* one of the most remarkable papers in the West, and it is as powerful in the affairs of the State of California as its older rival. Mr. Hearst's backing was, of course, liberal, but his success is by no means due to his father's money. He has the newspaper instinct. It is always difficult to explain exactly what this is. Mr. Charles A. Dana, pastmaster of the art, defined it a short time since in the *Sun*, as the faculty of doing things much quicker and better than the majority of other men can do them. Mr. Dana remarked that the faculty of achieving success in journalism deserved to rank as the rarest of human gifts, and that it was by no means worth while for anybody to imagine that he had it. 'It will be sure to prove itself to others,' said the *Sun*, 'and it is just as well for its possessor to remain unconscious. For a young man of talent and industry, but not of genius, who desires to make his way in the newspaper business, we recommend study, intelligence, moral integrity, great accuracy in the statement of facts and of principles, economy in living, first-rate health and a power of work equal to a steam engine's. With these he will get along, though he may never draw the greatest prize in the list of professional successes. The newspaper business is just like any other. Those who succeed in it are fewer than those who do not.'"

Isn't it nearly time you dusted off your little electric fan motor and oiled her up? Nothing like being ready.

The large attendance at the meeting of the New York Electrical Society, held at the Electric Club last week, would seem to indicate that a repetition of the event would result in mutual good to both organizations. There seems to be no good reason why these two organizations, and the Institute of Electrical Engineers, should not meet under one roof.

"Ten years from now all municipalities will own their own electric plants, their gas and water works, street cars, and will furnish heat and power to their citizens," says the Chicago *Inter-Ocean.* It has been proved time and again that even under existing conditions private corporations can do more satisfactorily everything mentioned above than municipalities. And if that Utopian day comes when private corporations shall have the same unrestricted franchises as municipalities, business will be run in such a way as to astonish our Cook County contemporary.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Boston Electric Club will hold a special meeting Monday evening, March 30. Matters of importance will be discussed.

Mr. Leopold Schlegelmilch, president of the Germania Electric Manufacturing Company, Marlboro, Mass., has returned from a three months' tour in Europe.

Mr. E. I. Garfield, secretary of the Thomson-Houston Electric Company, has returned from a business tour among his company's Western branch offices and agencies.

Mr. Geo. W. Alling, of the Crescent Steel Company, Pittsburgh, Pa., has been in the city several days catering to the electrical manufacturing interests of this section.

The Pettingell-Andrews Company, of this city, has been awarded a contract to supply about 12 miles of lead-covered wire for use on the Newburyport, Mass., Electric Street Railway.

The Merrimac Valley Street Railway Company, of Lowell, Mass., has been granted permission by the railroad commissioners to increase its stock from $80,000 to $250,000 in order to equip the former's road with electricity.

Mr. Geo. W. Mansfield, the well-known electrical expert, lectured before the Society of Arts, at the Institute of Technology, this city, Thursday evening, March 26, subject: "The Relative Value of Steam Railroads and Street Railways."

Removal.—The New England district offices of the Edison General Electric Company have removed to more extensive premises at No. 25 Otis street, this city. Mr. Sidney B. Paine is the district manager and Mr. Wm. H. Francis, district engineer.

Dr. Frederick D. Elliott, of Roxbury, Mass., gave a lecture before the Ladies' Physiological Institute, at Wesleyan Hall, this city, on Thursday afternoon, March 26. Dr. Elliott chose for his subject, "Some Uses of Electricity in Medicine and Surgery.

The Altham Motor Company has been organized at Portland, Me., for the purpose of manufacturing electric motors of various sizes under the Geo. J. Altham patents. The officers are: President, Geo. J. Altham, of Swansea, Mass.; treasurer, William W. Coe, of Somerville, Mass. W. I. B.

Boston, March 28.

OUR ALBANY LETTER.

The Senate has passed Mr. Laughlin's bill in relation to the filing of telephone and telegraph mortgages.

The Senate Committee on villages has reported to that body Mr. Gorman's bill on the electric lighting of West Troy.

Mr. Hitt's Assembly Bill allowing the bondholders of the Watervliet Turnpike Electric Railway Company to vote at annual meetings has been passed.

Senator Laughlin's Bill to incorporate the Buffalo and Niagara Power Company was lost in the Assembly, 25 affirmative to 42 negative votes being received.

Another Dynamo has been placed in the electric light station at Corning, N. Y. This makes a very complete arc lighting system for that enterprising little place. Work will soon be commenced for making the lighting system still more comprehensive.

The Albany Railway has been compelled to run horse cars on one of its North Pearl street branches again. The tracks were laid when the frost was in the ground and the Spring thaws have caused the road-bed to sink and the tracks to get out of order. The tracks will soon be relaid and put in order.

President A. B. Steele, of Herkimer, N. Y., has appointed the members of the new non-partisan Board of Electric Light and Water Commissioners. The appointees are Smith C. Harter, Geo. Weber, William B. Howell and H. M. Quackenbush. They are invested with power to appoint a clerk, treasurer and superintendent, and when the members of the board have qualified they will assume exclusive control of the water works and electric light plant.

A Hearing on Mr. Stein's bill to create a State Board of Telegraph Commissioners, and define their duties, was given before the Assembly committee on gas, water and electricity, this week. The bill was favored by Mr. Stein himself and Mr. J. F. Mooney, of Saratoga, and Mr. D. F. Waite, trainmaster, of Albany. Mr. Hamilton Harris opposed it and said that he could see no necessity whatever for its passage.

There was Quite a Stir Wednesday afternoon among the 26 attractive telephone girls who manipulate the switchboard in the main office of the Hudson River Telephone Company. The trouble was caused by the new switchboard, which has been put in the place of the one recently destroyed by fire. The construction differs from the former one, and the method of working it is more complicated. The fair operators have not yet had either the time or experience to qualify them for doing the same work with the new switchboard as with the old, and as a consequence subscribers have been delayed and some times disappointed in making switches. As these delays and disappointments have been frequent since the new board was put in, it made life a burden for the telephone girls. Manager Uline added five girls to the force, but even this did not mend matters. Wednesday morning the complaints were exceedingly vigorous, and when the manager dropped in at noon seven of the girls were found shedding bitter tears. They said they were no longer going to stay and have the public imprecations hurled at them. Manager Uline had a herculean task to prevail upon them to remain. He finally resorted to telegraphing to New York for two expert instructors in the intricacies of the switchboard. Then the tears ceased to flow and eyes were dried. The telephone service has improved since the experts arrived.

Albany, March 28, 1891. L. M. W.

OUR CHICAGO LETTER.

Mr. Jean A. Wetmore, of the Okonite Company, spent a few days in Chicago this week.

Mr. F. W. Cushing, secretary of the Central Electric Company, has returned from a month's sojourn in Florida.

The New Era Storage Battery Company are now in position to accept all orders they may receive for their improved batteries.

Mr. Chas. Munson, founder and president of the Munson Belting Company, died of heart failure, on Saturday, March 21. Mr. Munson was well known among electrical interests and his death is very much regretted.

Just Received at this office one of the very handsome illustrated catalogues of the Central Electric Company. It has just been published, is nicely bound, contains over 300 pages, is full of illustrations of the many excellent specialties handled by this firm.

The Illinois Electrical Material Company have secured desirable quarters on one of our principal thoroughfares and will shortly remove from their present quarters in the Rookery. They will have ample storerooms, basements, etc. They are fitting up elegant offices on the first floor and will, when completed, have as desirable quarters as any supply house in the city.

The Pennington Air Ship Model continues to make its regular flights with the aid of a ⅛ horse-power D. I. electro-dynamic motor and a small installation of accumulator cells, which are furnished by Mr. Hood, Western manager of the Accumulator Company. It is a novel sight to see this "creature" in the air apparently under perfect control. It is drawing good crowds and, I think, is paying quite well, although only a crude model is in use.

Mr. Osborne, of the Pumpelly Storage Battery Company, has just completed the installation of a plant of 180 cells of this battery, in the Davidson Opera House, Milwaukee. The cells receive their charge while the engines are running for the performance, and after shutting down take up and do the work of the dynamos. The factory of the above company has been removed to Chicago and the batteries are now being made under the special supervision of Mr. J. K. Pumpelly.

Aluminum.—There is much evidence that aluminum, deposited by electricity and an aqueous process heretofore considered an impossibility, is being manufactured in Chicago. Prof. Hirsch, of whom so much has been heard in the last few months, is said to be making, at his factory, at Twelfth and Rockwell streets, aluminum from common clay, which he gets right here. It has passed the experimental point as articles of all kinds and the metal itself are being manufactured for sale. The Hirsch Aluminum Plating Company has been formed.

The Electric Merchandise Company have organized a department in connection with their already large electric railway supply business devoted entirely to the rails, chairs, etc., and are to be congratulated upon securing the services of Mr. Frank X. Cicott as manager of the department. Mr. Cicott was for eight years in the general commission and supply business in San Francisco, being the representative on the Pacific coast for the firm of Holmes, Booth & Haydens. He was also coiner of the U. S. Mint, at San Francisco for a number of years; he is a man of wide experience and I do not know where a better man for this particular position could have been secured.

The Plans, etc., of the electrical exhibit building of the World's Columbian Exposition are expected at headquarters daily; the plans for this particular building are in the hands of Kansas City architects and are about completed. Professor Barrett, Chief of the Electrical Bureau, examined the proposed plans and has been invited to examine every detail of them in the office of the Superintendent of Construction, Mr. Burnham. This department will be well taken care of, all necessary space secured and the interests of those desiring space well looked after. Applications for space are coming in rapidly and, if necessary, arrangements will be made whereby additional building space will be secured.

Chicago, March 28. L. W. C.

VIEWS, NEWS AND INTERVIEWS.

The North River tunnel is progressing toward the New York end at the rate of 10 feet a day. About 3,340 feet of the total length, 5,400 feet, is completed. Negotiations are pending to substitute electric haulage for the mule cars now used in removing the core.

At the New York Electric Club the other evening, an electrical gentleman was safely delivered of this:

> The melancholy days have come,
> The saddest of the year,
> When it's much too warm for whiskey
> And not hot enough for beer.

It has been said that journalists lost a courteous friend when Mr. Allen R. Foote resigned the secretaryship of the N. E. L. A. This is so; but Mr. John W. Beane, the new secretary, is an old newspaper man and will be found ever ready and willing to assist representatives of the press.

Mr. William J. Hammer, the well known electrical engineer of this city, who represented the Edison interests at the Paris Exposition, was invited last week by the railroad committee of the New York Board of Alderman to give his views on illuminating the Fourth avenue tunnel. Mr. Hammer was unqualifiedly in favor of the incandescent electric light, with lamps of very high candle-power, if necessary.

New York Electrical Society.

A very interesting and largely attended meeting of the New York Electrical Society was held by invitation at the house of the Electric Club, 17 East Twenty-second street, the evening of March 27.

The lecturer of the evening was Mr. Joseph Wetzler, editor of the *Electrical Engineer*, who talked upon "Electrical Progress in 1890." Mr. Wetzler had the co-operation of the following inventors who described inventions and improvements made by themselves during the past year: Nikola Tesla, P. B. Delany, J. C. Chamberlain, J. J. Carty, C. O. Mailloux, F. J. Patten, J. C. Henry, Dr. W. E. Geyer, W. H. Bristol and G. W. Walker. Prof. Francis B. Crocker, who had expected to be present, was detained at home by illness.

Mr. Wetzler's remarks were well illustrated with carefully drawn charts and diagrams and, with the assistance of models each explained by the inventor, the entertainment provided was at once novel and instructive.

The large parlors of the Club were filled with the members of the Society and the Club, about 150 persons in all being present. Among those present were Park Benjamin, Henry A. Reed, Nikola Tesla, Herbert Laws Webb, Geo. M. Phelps, T. C Martin, Harold Binney, G. B. Muldaur, John A. Seely, Theo. Von der Lube, Dr. P. H. Van der Weyde, Dr. Otto Moses, Jos. Barré, R. H. Read, Dr. W. E. Geyer, J. J. Carty, W. H. Fleming, E. P. Thompson, W. H. Young and David Dudley Field, Ind.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, March 28, 1891. New York, Boston and Washington Stock Exchanges. Pittsburgh closing March 27.

NEW YORK.	
Western Union Telegraph Co.	80
American Telegraph & Cable	81
Central and South American	145
Mexican	210
Commercial Cable Co.	104¼
Postal Telegraph Cable	39
Edison General Electric Co.	102⅛
" " " "Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co.	79
United States Electric Light	30
North American Phonograph	
BOSTON.	
Thomson-Houston Electric Co.	43¼
" " " Preferred	24⅞
" " " Series C	9¼
" " " Series D	6½
" " International Co.	
" Welding Co.	
" European Welding Co.	55
Ft. Wayne Electric Co	139½
TELEPHONE:	
American Bell	*194
Erie	49
New England	50
Mexican	.90
Tropical American	.75
MISCELLANEOUS:	
Edison Phonograph Doll	
WASHINGTON.	
Pennsylvania Telephone	25
Chesapeake and Potomac	58¼
American Graphophone	6
United States Electric Light (Wash'ton)	107
Eckington and Soldiers' Home Electric Railway	58⅝
Georgetown and Tennallytown	60
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	11¾

*Ex. Dividend.

The Inventors' Congress.

The celebration of the Beginning of the Second Century of the American Patent System will be held at Washington, D. C., April 8, 9 and 10, 1891. The programme is as follows:

FIRST PUBLIC MEETING, Afternoon, April 8, 1891, presided over by the President of the United States.

Hon. Charles Eliot Mitchell, of Connecticut, Commissioner of Patents—"The Birth and Growth of the American Patent System."

Hon. O. H. Platt, LL.D., of Connecticut, U. S. Senator—"Invention and Advancement."

Hon. Carroll D. Wright, M.A., of Washington, Commissioner of Labor—"The Relation of Invention to Labor."

Hon. Samuel Blatchford, Justice of the Supreme Court of the United States—"A Century of Patent Law."

Hon. Robert S. Taylor, of Indiana—"The Epoch Making Inventions of America."

SECOND PUBLIC MEETING, April 8, 1891, presided over by the Hon. John W. Noble, Secretary of the Interior.

Hon. John W. Daniel, LL.D., of Virginia, U. S. Senator—"The New South as an Outgrowth of Invention and the American Patent Law."

Hon. Edwin Willitts, of Michigan, Assistant Secretary of Agriculture—"The Relation of Invention to Agriculture."

Mrs. Julia Ward Howe.

THIRD PUBLIC MEETING, Afternoon, April 9, 1891, to be presided over by Hon. Frederick Fraley, LL.D., President of the National Board of Trade and the American Philosophical Society and Charter Member of Franklin Institute.

Hon. Benjamin Butterworth, of Ohio, U. S. House of Representatives—"The Effect of Our Patent System on the Material Development of the United States."

Octave Chanute, of Illinois, President of the American Society of Civil Engineers—"The Effect of Invention upon the Railroad and Other Means of Inter-Communication."

Hon. A. R. Spofford, LL.D., Librarian U. S. Congress—"The Copyright System of the United States: its Origin and its Growth."

Thomas Gray, C. E., B. Sc., F. R. S. E., of Indiana, Professor of Dynamic Engineering, Rose Polytechnic Institute, Terre Haute—"The Inventors of the Telegraph and Telephone."

Col. F. A. Seely, of Pennsylvania, Principal Examiner U. S. Patent Office—"International Protection of Industrial Property."

FOURTH PUBLIC MEETING, Evening, April 9, 1891, to be presided over by Professor S. P. Langley, LL.D., Secretary of the Smithsonian Institution.

William P. Trowbridge, Ph.D., LL.D., of New York, Professor of Engineering Schoo of Mines, Columbia College—"The Effect of Technological Schools upon the Progress of Invention."

Robert H. Thurston, A. M., LL.D., Doc. Eng., of New York, Director and Professor of Mechanical Engineering, Sibley College, Cornell University—"The Invention of the Steam Engine."

Cyrus F. Brackett, M.D., LL.D., of New Jersey, Henry Professor of Physics, College of New Jersey, Princeton—"The Effect of Invention upon the Progress of Electrical Science."

Professor F. W. Clarke, S. B., of Ohio, Chief Chemist U. S. Geological Survey—"The Relations of Abstract Scientific Research to Practical Invention, with Special Reference to Chemistry and Physics."

Major Clarence E. Dutton, Ordnance Department, U. S. A.—"The Influence of Invention upon the Implements and Munitions of Modern Warfare."

ANNIVERSARY DAY, April 10, anniversary of the signing of the first American patent law—"An Act to Promote the Progress of the Useful Arts," by George Washington.

At 10 A. M., excursion to Mount Vernon, where an address will be delivered by J. M. Toner, M. D., of Washington, upon "Washington as an Inventor and Promoter of Improvements."

Special reception to inventors and manufacturers, and the ladies who accompany them, at the patent office, April 8, 9 to 11.30 P. M., by the Hon. John W. Noble, Secretary of the Interior, and the Hon. Charles Eliot Mitchell, Commissioner of Patents.

FIFTH PUBLIC MEETING, Evening, April 10, 1891, to be presided over by Prof. Alexander Graham Bell.

Hon. William T. Harris, Commissioner of Education—"The Relation of Invention of the Communication of Intelligence and the Diffusion of Knowledge by Newspaper and Book."

Prof. Otis T. Mason, Ph.D., of Virginia, Curator U. S. National Museum—"The Birth of Invention."

Dr. John S. Billings, Curator U. S. Army Medical Museum—"American Invention and Discoveries in Medicine, Surgery and Practical Sanitation."

Edward Atkinson, Ph.D., LL.D., of Massachusetts—"Invention in its Effects upon Household Economy."

PROGRESSIVE ELECTRICAL PATENTS.

CARBON FILAMENTS FOR INCANDESCENT LAMPS.

The usual method of manufacturing filaments for incandescent lamps consists in causing the common carbon filaments taken from the furnace to glow within an atmosphere of some hydro-carbon, causing thereby carbon to be deposited upon the filaments. A result of this treatment is that the size of the filament is somewhat increased by the deposited material and its resistance therefore lowered. In the use of a lamp the deposited carbon layer is removed by the influence of the current, so that the filament wears unevenly and becomes useless after the lapse of a certain period of use. Patents have recently been issued to F. G. A. Heller, of Berlin, Germany, and George Erlwein, of Berlin, for several modes of treating the filament so as to form a strongly coherent layer of refractory material thereon; for example, one method is to coat the filament after being taken from the furnace with chromium, either by an electrolytic process or by a chemical reduction of a metallic salt of chromium placed upon the filament. The filament so formed is said to be not liable to easy fracture, to have comparatively high resistance and great durability, without dispersion of its particles at high temperatures.

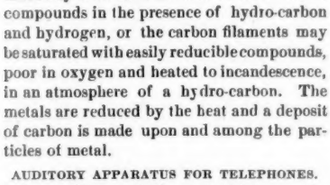
Another method consists in coating the filaments with metallic phosphides, the filaments being heated to incandescence in phosphorous vapor, or being first soaked in chlorides or oxides, and then heated in phosphorated hydrogen or in phosphine. The filament before being treated to the phosphorous vapor is provided with a coating of iron, platinum, iridium, palladium, molybdenum, chromium, manganese or tungsten, iron being the preferable metal.

Another method is to coat the filament with nitrides of silicon or boron, the coating being performed while the filament is at incandescence in an atmosphere of $Si\,Cl_4$ and ammonia. The silicon compounds in contact with the filament are reduced by the heat and form with the nitrogen of the ammonia solid nitrides of silicon, which are deposited nearly uniformly over the surface of the filament, forming a refactory coating therefor.

Another method is to coat the filament with a carbide of iron, chromium or manganese, and preferably manganese. The metal or base of the carbide is best deposited simultaneously with carbon from volatile metallic compounds in the presence of hydro-carbon and hydrogen, or the carbon filaments may be saturated with easily reducible compounds, poor in oxygen and heated to incandescence, in an atmosphere of a hydro-carbon. The metals are reduced by the heat and a deposit of carbon is made upon and among the particles of metal.

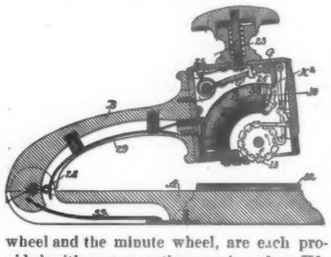
AUDITORY APPARATUS FOR TELEPHONES.

An auditory attachment, which may be connected to an ordinary Bell telephone receiver, has been designed and patented by Mr. George V. Benjamin, of Ithaca, N. Y. The device is illustrated in the accompanying engraving, wherein *a* represents a portion of an ordinary telephone. The attachment is connected by means of a cover *b* with an elastic packing *c*, and is provided with a central aperture which communicates through a flexible pipe with two ear-pieces *f f*¹. These are preferably cup-shaped and filled with some sound-muffling substance so as to prevent the interference of external noises with the hearing of the transmitted speech. The cups are connected with the tubes by a screw thread, and are provided with a flaring opening, and may be adjusted to a condition most suitable to the individual using the instrument. Valves *g g* to admit external sound are provided on the tubes or on the cups.



ELECTRIC TIME STAMP.

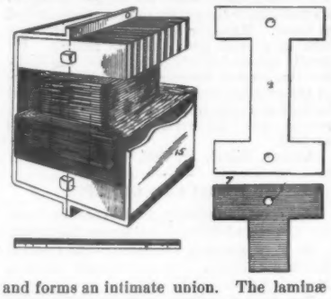
One of the many applications of electricity is the automatic adjustment of time stamps, mechanism controlled by a current being brought into action every minute to set a series of time and date disks so that when the stamp is called into service the month, date, part of the day, hour and minute will be recorded. In the accompanying engraving is illustrated a device of this character designed by W. B. Martindale, of Kenosha, Wis., and E. R. Malmborg, of St. Louis, Mo. The device comprises a bed-plate A upon which is pivotally mounted an arm B carrying the stamp mechanism, the mechanism being held away from the bed-plate normally by means of a leaf spring, 33. Within a box shaped enclosure mounted on the outer end of the arm is an electro-magnet, D, connected with a circuit by means of insulated conductor, 29, connected to one terminal of the circuit and the frame of the apparatus connected with the other terminal. A clock provided with a circuit-closer for closing the circuit every minute is electrically connected by the means just referred to with the electro-magnet. A spring-retracted armature, G^1, is pivotally supported near the magnet, and when the circuit is closed is drawn downwardly, and by means of a series of pawls, one of which is shown at K^2, shifts the date and time wheels, one of which is shown at 18. The month and year wheels are set by hand, but the day wheel and meridian wheel, the hour



wheel and the minute wheel, are each provided with a co-operating pawl, such as K^2. The minute wheel is shifted one step for each closure of the circuit, but the pawl which regulates the hour wheel is held away from the ratchet connected to said wheel by means of a disk attached to the minute wheel. When the minute wheel has made a complete revolution, a notch formed in its disk permits the hour pawl to drop into engagement with the ratchet so that the hour wheel is shifted to a new indication. A similar arrangement regulates the adjustment of the meridian wheel and the date wheel. In order to prevent the inertia of the parts when the stamp is used from disturbing the position of the wheels, a pivoted stop, 18, of magnetic material is supported in the path of the armature so as to prevent the arm from shifting the wheels unless the magnet is energized by the closing of the circuit. When the magnet is energized, the stop is drawn toward the magnet and out of the way of the arm, permitting the latter to descend and shift the disks. In order to prevent a shifting of the disks of the magnet if the circuit should be closed during the time an impression is being taken, a knob, 19, is mounted upon a spring cushion, 23, which yields sufficiently when the knob is struck to permit a spring, 25, to shift a latch, 24, and lock the armature G^1 against displacement, so that the armature cannot shift until the hand of the operator is taken from the knob.

FARMER'S CONVERTER.

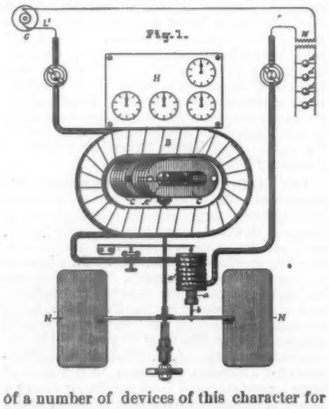
In making converters or devices for transforming currents of one tension into currents of another, through the instrumentality of variations of electromotive force due to interruption or gradual change, the iron core of the apparatus is usually built up of laminæ of iron separated from each other by thin layers of insulating material, such as paper, card board, etc., or the contiguous surfaces of the iron plates are oxidized or otherwise coated with some non-conducting layer, and in some cases the plates are assembled in metallic contact with each other without the intervention of any insulating material. In order to overcome the time and difficulty of assemblage of the sheets of iron and sheets of insulating material, Moses G. Farmer has designed a structure in which the laminating principle is retained, but in place of separating media of insulating material he uses very thin sheets of non-magnetic metal. Both the plates of iron and the plates of non-magnetic metal are tinned by dipping or otherwise, and two plates, one of each kind, are sweated together so that the tin is melted



and forms an intimate union. The laminæ of iron are thus surrounded by non-magnetic material, and may be handled as an entirety and readily assembled in building up the core of the converter. The lines of force are confined to the laminæ of iron when the converter is in action, and, it is stated, excellent results are secured. In the accompanying engraving, Mr. Farmer's structure is illustrated. In the detached views are shown an I-shaped piece of non-magnetic material, 1, which is tinned on all sides, and a T-shaped piece of iron having a stem about half the length of the stem of the I. This is tinned on all sides except the top edge of the T, and two such pieces of iron are laid upon the I-shaped piece of non-magnetic material and sweated together by heat. Such a compound plate is shown in one of the detached views. The plates are perforated on the edges and strung upon bolts to the requisite size to form the converter core and wound with the primary and secondary coils, and then enclosed within an iron evelope, 15, which forms a magnetic circuit through the central core out on the ends of the I and from the exposed iron outer edges thereof to the envelope. A slight interruption of this circuit occurs at the adjoining edges of the T-shaped laminæ of iron, a thin layer of tin intervening at this point, which interruption of the magnetic circuit, it is claimed, produces improved results.

SHALLENBERGER'S ALTERNATING CURRENT METERS.

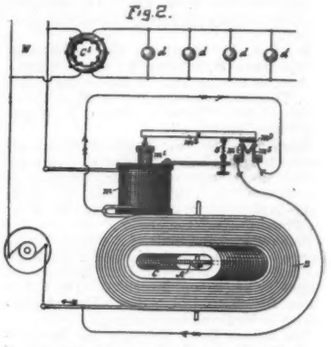
The demand for an efficient and honest electric meter has led to the invention of a great variety of apparatus for recording the amount of current consumed in a subscriber's circuit. The rapid introduction of alternating currents has led to the invention



of a number of devices of this character for indicating the amount of alternating current used. By reason of the rapid reversals of current, such apparatus is essentially different in its construction from direct current meters. Habitual readers of this journal are familiar with the meter designed by O. B. Shallenberger, patented in 1888, comprising two coils, one of which is interposed in the alternating circuit, and the other of which forms a closed circuit and is placed near the other coil with its axis at an angle thereto, a disk armature being placed within the inner coil and having its spindle connected to a recording mechanism. The difficulty with this apparatus is that by reason of more or less leakage through the primary coils of the converters even when no work is being done in the secondary or consumption circuit, a meter placed in the primary circuit would record the flow of such leakage currents and be continually operated even though no useful work were being done. The device is therefore open to the objection that the subscriber is made to pay for current not actually consumed in useful work, unless a deduction in the amount of bill on account of leakage is made by the company. Even if the meter is inserted in the secondary circuit, there will be sufficient leakage to render the account of the meter more or less unreliable. In order to remedy this difficulty, Mr. Shallenberger has invented further improvements in his meter which are herewith illustrated.

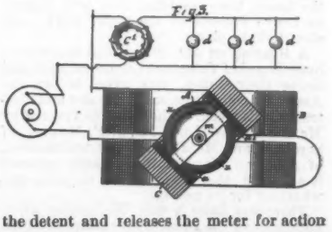
In the first form shown in Fig. 1 is illustrated the old form of meter with an auxiliary device for preventing its action until current is actually being used in the work circuit.

Fig. 2.



For the benefit of such of our readers as may not be familiar with the old form of meter above referred to, it may be stated that the device comprises a primary coil B, an enclosing secondary coil C set at an angle to the primary coil, and an armature A enclosed within the coil C, said armature being fixed upon a spindle which controls a registering mechanism H. When current flows through the primary coil B, by reason of the variation of electromotive force of the alternating currents, currents are induced in the coil C. The poles induced in the armature by the coil C are acted upon by the poles induced in space by the coil B and develop a rotary tendency in the armature, the speed of travel of the armature depending on the strength of current circulating in the coils, which in turn depends upon the amount of current being used in the subscriber's circuit. W represents a converter, the secondary coil of which supplies the lamp or motor system *d d d*. The improvement which Mr. Shallenberger has now made resides in the provision of a detent *b*, which prevents the fan N, attached to the armature spindle and which serves as a damper to rotation, from rotating until a definite current strength passes in the primary circuit. The detent will not be removed from the path of the fan until the current has reached a strength in excess of the normal amount of leakage. The detent is controlled by a solenoid a^1 interposed in the meter circuit, which solenoid acts upon a bundle of soft iron wires *a* and draws up

Fig. 3.



the detent and releases the meter for action when the current strength reaches a value in excess of the amount of leakage and sufficient to raise the core of the solenoid.

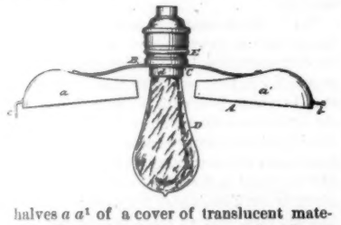
Another method of accomplishing the same result is illustrated in Fig. 2, wherein, instead of the mechanical detent just described, a short circuiting device is used which normally cuts the meter out of circuit until the current reaches a value in excess of the leakage, when the amount of current

flowing through a solenoid m, which is in series with the meter, will draw down a core n^1 and lift a metallic bridge normally connecting two contact springs m^4 m^5 and thus open the normal short circuit indicated by the arrows and force the current to flow through the meter and cause the latter to register. The lever m^2 upon which the metallic bridge is mounted, is provided with a ragulating spring s, which may be adjusted to a tension representing the amount of normal leakage.

Still another improvement devised by Mr. Shallenberger is illustrated in Fig. 3. In this form the armature A is given a normal bias by cutting it away on the ends of its diameter, which causes it to assume the position indicated in the diagram; that is, with its longer diameter in the axial line of the coil C. When then current strength reaches a value above the amount of leakage, this bias is overcome by the coil D and the armature thrown into rotation. The action may be further intensified by surrounding the armature with a copper coil m.

COMBINED COVER AND REFLECTOR FOR INCANDESCENT LAMPS.

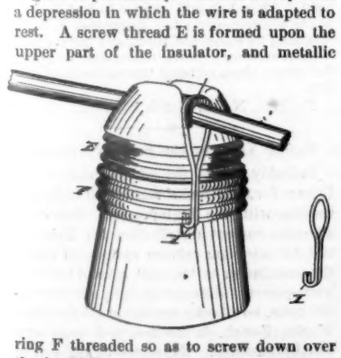
It is often desirable where incandescent lamps are used for domestic purposes, to have the light dimmed or reduced at certain times, and at other times to have it arranged to give a maximum degree of illumination. A contrivance for accomplishing this result has been designed by E. T. Mueller, of La Crosse, Wis., and is illustrated in the accompanying engraving. The device comprises a metallic spring B provided with a central ring by which it may be fastened to the socket of an incandescent lamp, and on the ends of the spring are mounted the two



halves a a^1 of a cover of translucent material. This material may be made of any suitable material such as paper, or paper lined with tin-foil, so as to furnish a good reflecting surface when the parts of the cover stand in the position indicated in the engraving. When, however, the two parts are pressed downwardly and the latch c on one-half of the cover is hooked over the projecting pin b on the other half the lamp is completely enclosed and the light subdued. When it stands in the position indicated in the engraving it acts as a reflecting surface and increases the amount of light shed upon all points below the lamp.

IMPROVEMENT IN INSULATORS.

In the accompanying engraving is illustrated an improvement in electric insulators recently patented by Messrs. Graham and Gannane, of Chicago. The device is made of glass or porcelain provided at its top with a depression in which the wire is adapted to rest. A screw thread E is formed upon the upper part of the insulator, and metallic



ring F threaded so as to screw down over the thread E, co-operates with a hook I having a loop at the top for surrounding the wire. As the ring F is screwed down it carries the hook with it and tightens the loop around the wire, thus binding the latter firmly in place in the notch in the insulator. The lower end of the insulator is provided with a recess so as to form a hood in a manner usually adopted in the construction of such devices.

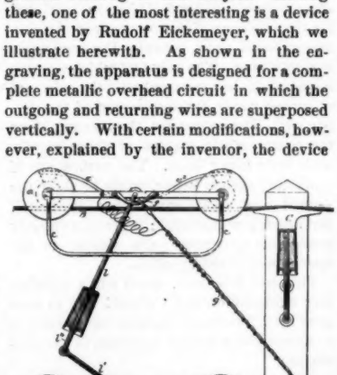
COMMUTATOR BRUSHES.

Among improvements in the matter of detail in dynamo electric machine and motors, one of the most important of comparatively recent adoption is the use of carbon brushes. Such brushes are sometimes made of a single piece of carbon bearing upon the commutator and sometimes of a number of independent sticks of carbon placed side by side. An improvement in the latter form has recently been made by Frank A. Perret, of Brooklyn, which is illustrated in the accompanying engraving. The brush holder consists of a metallic block fixed upon a suitable support and provided with a series of perforations arranged zigzag fashion, as shown

in the perspective view, in which are placed sticks of carbon. The upper portion of the walls of these perforations is tapped with screw threads for the reception of screw plugs, as illustrated in sectional view. The sticks of carbon are dropped in the perforations and the screw plugs provided with tension springs are adjusted until the proper degree of pressure upon the commutator bars is produced. As the brushes wear, the amount of wear may be compensated by further adjustment of the screw plugs. By staggering the holes or arranging them in zigzag fashion, the sticks of carbon are made to cover the entire longitudinal surface of a commutator bar and evenness of wear is thereby assured.

ELECTRIC RAILWAY TROLLEY.

Perfection in detail is in no art more conspicuously important than in that of electrical engineering. The importance of maintaining a good connection between the traveling trolley or collector of an electric railway and the supply conductor, seems to be a matter of increasing value in the estimation of electricians, if we judge the matter by the number of patents which have recently been granted relating to this subject. Among these, one of the most interesting is a device invented by Rudolf Eickemeyer, which we illustrate herewith. As shown in the engraving, the apparatus is designed for a complete metallic overhead circuit in which the outgoing and returning wires are superposed vertically. With certain modifications, however, explained by the inventor, the device



becomes equally efficient with the two wires in the same horizontal plane. The two collectors are connected by links l l^1 pivoted to the trolley frames and pivoted together, an insulating junction shown at l^2 forming part of the connection. The arms of the links are bent in a horizontal plane and journaled in the two side bars of the trolley frames, and the pivotal connection at l^2 has a long horizontal bearing so that the trolley frames are rigidly connected so far as lateral displacement is concerned, but are capable of yielding in the direction of travel of the car or in a vertical plane, and thus either trolley may yield when an unusual strain is thrown upon it by reason of a variation of inclination of the wire with which it contacts, and the two frames are permitted to accurately accommodate themselves to a variation in distance between the two supply wires resulting from any cause. In order to create a certain amount of drag in the trolleys and prevent them from shifting with relation to the car and thus subjecting the system to unusual strains and jerks, a brake is used comprising a spring e^1 e^2, and a pair of brake shoes bearing upon the periphery of the trolley wheels. The trolley wheels are provided with deep grooves in the usual fashion to prevent them from jumping from the conductor, and as an auxilary provision against such a result, side guards c, one on each side of the trolley, are secured to the frame or axles and droop below the level of the supply wire. If, therefore, the trolley should jump from the wire, these guards will hold it in alignment so that it will settle back into place. The draft wires are represented at g, and the conductors for leading the current from the trolleys to the locomotive are supported on such draft wires. The friction of the brakes can be made sufficient if desired to cause the wheels to take a partial sliding and partial rolling motion with reference to the supply conductor, thus insuring a perfect contact and a consequent diminution in resistance. C represents supports mounted upon and insulated from suitable brackets secured to the poles arranged at suitable intervals along the railway.

ELECTRIC CLUBS.

New York Electric Club.

The Annual Meeting of the Club occurs Thursday evening, April 16. The voting will begin at 5 o'clock and close at 8 o'clock. It is expected that a big vote will be polled and an interesting election held.

At the Special Meeting of the Board of Managers held Thursday evening, March 26, some 30 new members were elected. Among these were Edward Weston, Charles Fisbel, U. N. Bethel, W. A. Vail, H. L. Webb, Harold Binney, W. H. Gordon, F. C. Timpson, H. G. Madden, R. R. Whitehead, I. H. Matthews, Jr., H. A. Foster, H. H. Harrison, L. W. Serrell, R. B. Corey, A. A. McCreary, Chas. P. Bruch, A. M. Goodale, F. H. Whipple, T. Grinwood, Ira W. Henry, W. C. Bryant, Theo. Beran, E. L. Draffen, L. S. Dumoulin.

Recent Out-of-Town visitors were: W. F. Hair, Chicago; T. McCoubray, Baltimore; L. S. Dumoulin, Boston; Chas. P. Sclater, Montreal; N. M. Beach, Bridgeport, Conn.; David Dudley Field, 2d, Stockbridge, Mass.; A. Vaughn Stevens, London, Eng.; W. K. Sheldon, Rutland, Vt.; D. C. Robertson, St. John, N. B.; P. F. Ferrell, Wheeling, W. Va.; H. D. Reed, Newark, N. J.; W. Boardman Reed, Schenectady, N. Y.

Electrical Association of Pennsylvania.

At a meeting of electrical men held in Harrisburg, Pa., March 17, 1891, the Electrical Association of Pennsylvania was organized, a constitution and by-laws were adopted and the following officers elected: President, Robert E. Wright, Allentown, Pa.; vice-president, J. K. Ewing, Uniontown, Pa.; secretary and treasurer, Clarence A. Wolle, Bethlehem, Pa.; executive committee, D. Hyman, Harrisburg, Pa.; John A. Latham, Mahanoy City, Pa.; B. F. Overholt, Scottdale, Pa.; P. J. Ferguson, Shenandoah, Pa.; E. D. Mullen, Philadelphia, Pa.

An Electrical Society for Quincy, Ill.

An Effort is being made to organize an electrical society in Quincy for the study of electricity as applied to power, light, the telegraph and telephone. Quite an interest is being taken, and a meeting will probably be called some time this week for organization.

An Original Artist who Believes in the "Flow" of Electricity.

TO THE EDITOR OF ELECTRICAL REVIEW:

As yours is a progressive paper, I thought perhaps you would like to publish a new theory which I heard advanced some days since by an Alabama electrician.

He is superintendent of the gas plant at the Insane Hospital of the State. What called forth his suggestion was this: The Faculty had replaced the old watchman's time detector by an electrical one, the battery of which was placed in the cellar beneath. For some cause or other the system got out of order and the "gas" man was called up to remedy the trouble. After looking it all over, he came to the conclusion that on account of the battery being down stairs the electricity exhausted itself by having to *run so far up hill*. So he at once went to work to increase the pressure by putting the battery on the floor above and so give it more fall. The watchman still sleepeth.

A. R. SMITH.

Tuskaloosa, Ala., March 24, 1891.

* * A progressive hotel at Attleboro, Mass., runs its ice cream freezer by an electric motor.

* * The Toledo, Ohio, Electric Street Railway has increased its capital stock to $800,000 from $600,000.

* * Fire did $20,000 damage to the car house of the Citizens' Traction Company, Pittsburgh, March 24.

* * The electric road connecting Berkeley and Oakland, Cal., is to be in running order in the early part of May.

* * The act to incorporate the Chester and Derry Electric Railroad Association has passed the New Hampshire House.

* * An electric railway to connect Boston and Lynn, Mass., by a route along the beach, is being agitated by prominent parties.

* * The Becker Electric Street Railway, of Milwaukee, Wis., has been mortgaged to the New York Loan and Trust Company for $1,000,000.

* * Cambridge seems to be yearning for the old-fashioned horse car in place of the new-fangled trolley. By all means let her wishes be gratified.—*Boston Herald.*

* * It is claimed that the opposition of the Williams College authorities will prevent the building of an electric railroad from North Adams to Williamstown, Mass.

* * A line of electric railway has been put in between Urbana and Champaign, Ill., a distance of one mile, and cars run in each direction every twenty minutes during the day.

* * The Essex Electric Street Railway Company, of Salem, Mass., denies that it has made any offer or has any idea of purchasing the Beverly and Danvers storage battery road.

Annual Meeting of the Stockholders of the Burton Electric Company.

The annual meeting of the stockholders of the Burton Electric Company was held in Richmond, Va., on the 25th of March, when W. R. Mason, of the Electric Merchandise Company, of Chicago, was elected president; W. J. Johnson, president Citizens' Bank, Richmond, vice-president; C. E. Wings, treasurer; A. Pizzini, secretary, and W. Leigh Burton, superintendent.

Reports of officers showed the company to be in a prosperous condition. Superintendent Burton reported a large stock of electric heaters on hand which had been paid for from part sales, and from recent testimonials of the satisfaction the heaters are giving in various parts of the country, he anticipated large sales in the future.

President Mason will be a valuable acquisition to the Burton Company, as his connection with a large electrical supply house places him in a peculiarly favorable position for bringing the Burton electric heater to the attention of electric railways.

Business Notes.

The Electrical Supply Company, Chicago, recently received a letter from the Piqua, Ohio, Electric Light and Power Company containing the following passage:

"We have had about 30 miles of three braid Shield brand wire in use for over a year and consider it to be the best line wire we can get. Our order is in your Mr. Burdges hands for about 900 pounds to extend circuit."

The Eureka Tempered Copper Company, North East, Pa., has received the following letter:

LATROBE ELECTRIC LIGHT COMPANY,
LATROBE, PA., Dec. 6, 1890.
EUREKA TEMPERED COPPER CO.

Gentlemen:—We are pleased to say to you that our experience with tempered copper for segments and brushes is that it far excels brass in every way; lasts longer, gives better results and is much cheaper.

We enclose checque in voucher for goods to date Yours truly,

THE LATROBE ELECTRIC LIGHT CO.
W. A. Johnston, Sec. and Treas.

ALTERNATING CURRENTS OF HIGH FREQUENCY.

BY CHAS. STEINMETZ.

[Written for the ELECTRICAL REVIEW.]

I read, with great interest, Mr. Tesla's and Prof. E. Thomson's account of their experiments with alternating currents of very high frequency; the greater, as my experience with high speed alternating machinery enabled me to fully appreciate the enormous difficulties connected with the mechanical production of such enormous frequencies.

Indeed, in my experiments I never went by far so high as they did; and I am not musician enough to judge whether such a machine would be fit to accompany a thoroughly Wagnerian opera, as Mr. Tesla thinks; but, at least, I doubt it, because the one machine—of a design somewhat similar to his—which I once built, gave out a howling resembling much more an Indian war-whoop, only a little more frightening, than anything else. And it was a very remarkable machine, too; the boys in the shop called it the "humming bird," and it goes now by this name. Perhaps I shall refer at a later occasion to the interesting experiments made with this machine, which, among other features, gave continuous magnetization from alternating currents without commutation.

It seems, indeed, that the advantages of reaching such high frequencies, not by static discharges, but with machines powerful enough to yield perceptible *currents* of electricity, amply compensate for all the difficulties encountered therewith. Because these experiments made with frequencies of 20,000 to 30,000 per second, form the connecting link between the phenomena of the alternate currents used in practical engineering, and those electric disturbances of millions or hundreds of millions of vibrations per second, which give rise to the Hertzian ether waves of radiating electricity.

And this fact explains all the experiments shown by Mr. Tesla and Prof. Thomson. Most of them, indeed, show truly static effects of oscillating electric disturbances, like the oscillating discharge of the induction coil in Hertz's experiments, only that in this case where the electric disturbances are backed by *currents*, which count by horsepowers, much more brilliant effects appear.

It is certainly not *conduction* through the air which makes an incandescent lamp, entirely disconnected from the machine, light up, but it is the action of the radiating energy of the electric ether waves. Not the secondary current of the induction coil is felt by the hand which holds the incandescent lamp, but the electric charge influenced in the hand as the outer condenser coating, just as we draw sparks from the outer coating of a Leyden jar, when the inner coating is charged by a static-electric machine, and feel every spark which jumps over from the machine conductor to the inner coating.

Various forms of the screening effect of metals, with regard to those waves, are shown by Mr. Tesla. Reflection and refraction, indeed, he could hardly expect to observe, because, even with 30,000 alternations per second, the wave length of the electric disturbance in space amounts still to something like seven miles.

But the whole space surrounding such a machine has to be considered as an electromagnetic field of force, and a very powerful one, too, because of the enormous strain exerted upon the dielectric by the high pressure of the induction coil.

It is only to be regretted that in all the reports of Mr. Tesla's experiments nowhere anything is stated about the E. M. F. of those electric secondary currents. This omission rather impairs the value of these experiments somewhat. The E. M. F. of the primary current Mr. Tesla gives as 500 volts. But how did he measure an alternating pressure of 30,000 vibrations per second; by static electrometer? Because any dynamometer would be unreliable under these circumstances.

I think, although any closed circuit voltmeter would be entirely out of question for such high frequencies, a modified electrometer, built for very low capacity, would, perhaps, answer the purpose of measuring the secondary E. M. F., and could be built so that it could be used for determining the E. M. F. and also the electric energy, that is, the power consumed by the circuit. This seems to me of very great importance, because it would give the means to determine by experiment the amount of electric energy which radiates into space as electric ether waves, that is, the time hysteresis of air.

I should suggest to determine the whole energy of the electric current by an electrostatic wattmeter, and the energy converted into heat in the conductor by a calorimeter. The difference would give the energy of radiation. Indeed, enormous practical difficulties would have to be overcome to carry out this scheme.

The condenser, such an inefficient and cumbersome apparatus for circuits with the usual number of periods, becomes very powerful and compendious for such high frequencies as 30,000 per second, and systems of electric distribution by means of condensers would be very well conceivable, if much higher frequencies now could be used in practical engineering. Already some years ago such a system of distribution by condensers, with a frequency of, I believe, 800 per second, was proposed by a European electrician, but never tried, I suppose. (Account of it is to be found somewhere in the "Centralblatt für Electrotechnik," Munich, Germany.)

However, I believe that for electric light and power distribution such frequencies as Mr. Tesla used are quite out of question, and I am much more inclined to think that even the frequencies now in vogue in this country, of in maximo 138 complete periods per second (Westinghouse), or 16,000 alternations per *minute*, will not be kept much longer, but will be reduced as soon as possible. They are now used only because of the small unit of converters found in this country, which for efficient work need a high frequency.

But I entirely agree with Mr. Stanley that it is most desirable for efficient work to proceed to larger converter units, and that then a reduction of the number of alternations will be made. In the old country, where the practice is to use the converter as a kind of secondary station and to feed a whole district from one converter or a bunch of converters, the converter unit is much larger generally, and therefore a much lower frequency, only 42 complete periods per second, permissible. This reduces the loss by hysteresis very greatly, and this loss is known as the most important factor, because of being about the same for no load as for full load, and especially determines the all-day efficiency.

Indeed, even in this country, for arc lighting by means of alternating currents and series converters, the number of alternations has been reduced already to one-half, 8,000 reversals per minute, in the Stanley-Westinghouse constant current alternator, I think, because it was very difficult to work any electromagnetic regulating mechanism with the frequencies of incandescent light currents.

It is not the question whether magnetism can be produced at all by very rapidly varying currents, but the question of *self-induction*, that is, whether a current strong enough to work the regulating mechanism can be forced through its energizing coil against the counter E.M.F. of self-induction, without consuming too much pressure, which limits the number of vibrations permissible in electro-magnets and motors.

I will not try to decide which is the highest number of periods permissible for effective working of alternating motors, and whether this limit is higher than the number of periods practically used; but it must be borne in mind that until now no alternate current motor is on the market which runs with halfway fair efficiency with the number of alternations used for incandescent light circuits, 16,000 per minute, while in Europe, where a much lower number of alternations, only 5,000 per minute (Ganz & Co.), is used, alternate current motors are already on the market and in practical use and reach a very fair efficiency. And, nevertheless, in the use of electricity as motive power, the United States are undoubtedly a long way ahead of other countries.

As before said, it is not the impossibility of producing magnetism by rapidly varying currents, which makes them unfit to run motors, but the enormous self-induction, which necessitates the waste of an enormous pressure to send even a small current through the inductive resistance.

For magnetism is produced with still much more rapidly oscillating currents than those which Mr. Tesla had at his disposition, as the fact proves that magnetization, and even permanent magnetization of steel rods, has been produced by oscillating condenser discharges and lightning strokes. Steel rods were found permanently magnetized at such occasions and the curious phenomena was, that by grinding off the surface of the steel rod, the magnetism decreased—reached zero, reversed its polarity—increased by further grinding off to a maximum in the opposite direction as that of the magnetism of the integer rod, and then decreased again and even reversed its polarity once more.

The explanation for this phenomenon is, that the discharge was oscillating, with increasing wave length but decreasing intensity. The first wave magnetized only the very surface of the steel rod strongly, but because of its very short duration and the screening effect of the metal, did not enter deeper into it. The second wave, of opposite direction, was not strong enough to reverse the magnetism produced by the first wave, and only weakened it somewhat; but because of its longer duration it entered deeper into the steel and magnetized the layer underneath in the opposite direction to the surface, so that by grinding off the surface layer the magnetic moment of the rod reversed; and if the resistance of the electric circuit was low enough to allow a third wave to be produced with perceptible intensity, underneath the second layer a third one was found, magnetized in the same direction as the surface. This phenomenon shows that even such very rapid oscillations produce magnetism.

I was very much interested in reading the arguments which Prof. Thomson proffered for the existence of carbon vapor in the electric arc and I must consider the arguments as very strong. The only fact which seems to me not quite in agreement with the existence of carbon vapor, is the spectrum of the electric arc. The copper arc, the iron arc, show the characteristic spectra of those metals, with their many lines. The carbon arc, if containing carbon vapor, ought to show the —until now unknown—carbon spectrum. But nothing of that kind; it gives an entirely continuous spectrum, quite similar to the spectrum of glowing solids.

This fact, I believe, needs still a satisfactory explanation, and I should like to hear how Prof. Thomson explains the absence of a characteristic carbon spectrum in the electric arc.

I should like to hear, also, whether any experiments have been made to determine the exact temperature of the arc and the glowing carbons. The only temperature determinations of which I know are already of rather old date and made by an Italian, Rosetti, which measured the heat radiation by means of a thermopile and found the temperature of the tip of the positive carbon to 3,900 degrees C., the tip of the negative carbon to 3,150 degrees C., but the temperature of the flame higher—4,800 to 4,844 degrees C. These figures do not agree with the data given by Professor Thomson, who considers the positive carbon as the hottest part of the circuit. Rosetti used currents from three to six amperes.

The explanation of the instability of the electric alternating arc, because of the alternating cooling off of the carbons during the zero period of the current, is certainly the nearest one and, therefore, generally accepted. But whether it agrees with the real proceedings must still be doubted. Theoretically, at least, these fluctuations of temperature should be expected to be so small that they could have no influence on the conductivity of the arc.

An experiment to determine the fluctuations of temperature of an electric conductor, caused by the alternations of the current, was made on a piece of copper wire, one millimetre thick and 657 centimetres long. A current of 6.4 amperes was sent through with only 5,840 alternations per minute, and the lengthening of the wire measured. The increase of temperature was 37 degrees C.; but the maximum variation of temperature calculated to only .019 degree C., that is, one-twentieth per cent. of the whole rise of temperature. ("Das Gesetz zwischen Ausdehnung und Stromstärke für einen von galvanischen Wechselströmen durchflassenen Leiter," von Dr. Cranz, Zeitschrift für Mathematik und Physik, Dresden, 1889, p. 92.) Although this calculation is not quite conclusive for the somewhat different conditions in the electric arc, it is sufficient for making the assumption of so great and rapid cooling down of the arc during the time of zero current doubtful.

But if we consider the energy consumption of the arc as caused by a counter E.M.F., a kind of polarization, and at the hand of the facts must assume that this counter E.M.F. of the arc in very wide limits is nearly independent of the current strength, then the apparent resistance of the arc must vary inversely as the current intensity, and in consequence of this, in an ordinary alternating arc light circuit, the height of the current wave must be increased at its crest, decreased near its minimum position, so that the time of minimum current is greatly increased, and the shade of the wave becomes more triangular.

But if the alternator is so well self-regulating that the current wave, in spite of the varying resistance, is kept sinusoidal, that is, regulating in time so short that it is small even in comparison with the wave length of the alternating current, as is the case in the Stanley-Westinghouse constant current alternator, then the alternating arc should become just as steady as the continuous current arc. Now, in Mr. Tesla's high frequency machine this condition was certainly fulfilled, its self-induction being very large, as the tendency of yielding constant current shows, and self-induction regulated the impressed E.M.F., according to the sine-wave of the current producing the rectangular shape of the wave of impressed E.M.F., as shown in the curves given by Messrs. Tobey & Walbridge, for the Stanley-Westinghouse alternator, in their paper read before the American Institute of Electrical Engineers.

This particular shape of E.M.F. and current might have a great deal to do with the steadiness or unsteadiness of the arc.

Therefore, it would be of very great interest, in the same way as it has been done in Cornell University with the Stanley-Westinghouse alternator, to determine the shape of the E.M.F. and the current wave for an alternator of very low self-induction, for instance, with a disk armature, running arc light. Then I should expect to find the opposite phenomenon; the impressed E.M.F. retaining its sinusoidal form, and the current wave assuming a more triangular shape, at the same time causing unsteadiness of the arc.

Yonkers, N. Y., March 26, 1891.

25,000 Volts by the Brooks' System.

Probably one of the largest fields of usefulness for the Brooks' mains will be in connection with the high-pressure three-wire alternate current distribution for lighting, and for alternate current motors, of which the installation to transmit several hundred horse-power a distance of 12½ miles at 25,000 volts, now being erected at the Oerlikon Works, Zurich, is the first and most noteworthy example. Examples of the use of underground transmission in towns where overhead wires cannot be employed will probably not be long in being seen in practice. The details of the Brooks' mains for this system have already been carefully worked out, and details will be given of this interesting system next week.—*From the London Electrical Engineer.*

Electric Lighting in Australia.

Recent reports from Australia indicate that the people of that country are now rapidly awakening to the advantages to be derived from the utilization of electric light and power. A central station plant of electric lighting has just been completed at Newcastle, which operates the Westinghouse system of alternating current central station apparatus.

The installation of the plant comprises arc lamps and incandescent lamps. The machinery for generating the electric current is driven by Westinghouse compound engines. The plant is composed of Westinghouse alternating current dynamos and exciters. Steam for the electric plant is generated by Babcock & Wilcox boilers, working up to 120 pounds pressure per square inch. The switchboard controlling the lighting arrangements is the most complete and perfect in the Australian colony. By its means the light can be switched on and off at any given point in the town. The street lights are worked on two independent circuits, and there are also two independent circuits for private lighting. The exciters and dynamos for the plant were manufactured by the Westinghouse Electric and Manufacturing Company at their works in Pittsburgh, Pa. The installation of the apparatus was superintended by an engineer of that company, who had been sent purposely to Australia.

To give an idea of what the public in Australia think of the plant, the following from the *Australian Mining Standard*, of February 14 last, is published:

"The public and council of Newcastle are more than pleased with the success of this installation. The plant has now been running for six weeks and no break has occurred since the moment the lights were first turned on. In the adoption of the electric light the town of Newcastle has provided another example of its enterprise and progressive spirit. The advent of the electric light created some little commotion at first, but the fiat had gone forth, and now a mild outburst of jubilation testifies to the installation of the electric light as a great public convenience. The occasion is certainly one of the greatest importance to the whole of the municipal centers in Australia, and we would advise any municipal corporation in the colonies, who have the intention of putting up an electric light plant, not to make up their minds until they have seen the system operated at Newcastle."

H. C. F. Koch & Company's Electric Light Plant.

The above-named company has recently completed a handsome four-story dry goods house in West 125th street, this city. A public opening was held on March 25, preceded the evening before by a press and trade opening.

An electric light plant has been installed under the personal supervision of Mr. Charles H. Davis, C.E., 120 Broadway, this city. The following description will be interesting, as the plant is one of the handsomest and best designed of the many isolated plants in this city:

The current is generated in the basement, from two Thomson-Houston compound wound dynamos, one of 800 light, and one of 400 light capacity. Each machine is driven by an indepeudent high speed "Ideal" engine of 80 and 40 horse-power respectively, which, with a separate circuit to each floor, insures light to the building at all times.

Heavy foundations have been provided for this machinery, effectually preventing vibration from being transmitted to any part of the building. The belt centers have been made exceptionally long, with light noiseless running as a result. The Underwood cotton-leather belting is used.

The main switchboard is located in the dynamo room, and is so arranged as to allow the machines to operate together or alone on any or all circuits. It is made of enameled slate and has voltmeters, ammeters, rheostats, switches and all necessary con trolling devices upon it. A separate circuit runs to each floor feeding a panel of slate with local switches, giving an elaborate control of the lights. The show window deserves special mention, being lighted as is no other window of its kind in New York. The lights here are placed against the ceiling, with 12-inch, double glass, reflectors for each light. There are ten lights to each window, 40 in all. These reflectors are the feature of the show window lighting, being made of glass front and back, the space between filled with a mercury compound, and hermetically sealed. They never tarnish, are extremely bright, and with ground glass lamps reflect a powerful but soft light. These reflectors are manufactured by the Thackera Manufacturing Company, of Philadelphia, and were invented by Mr. Sawyer, of that company.

A good idea of the lighting is given when one knows that there are 172 ceiling fixtures, 265 silk cord drops, 41 receptacles, 57 reflector lights, 4 newel fixtures, 8 bracket fixtures, or a total of 542 outlets and 1,007 16-candle power lights. Such distribution and variety was used in order to place the lights advantageously for the purpose intended.

There are 100 switches, giving absolute and convenient control of all lights. Grimshaw white core wire has been used, it being placed in moldings run on the stringers in the air spaces between the floors and iron ceiling.

The mains from the basement are run in moldings placed in position by plugging walls and screwing thereto. They are finished to conform with the surrounding woodwork. All concealed molding is painted inside and out with P. & B. waterproof paint. All lights are controlled by switches located in the main pocket, one for each floor, where all fuses are also placed.

This plant is simple in its design and construction, and is especially flexible in its control. The work was designed by, and executed under the direct supervision of the consulting engineer, Charles H. Davis, C.E. The contractors were: Engines, W. R. Fleming & Company; electric plant and wiring, Thomson-Houston Electric Company, and fixtures, The Mitchell Vance Company. The cost of the plant was about $13,000.

A Waterproof Cut-Out.

We illustrate in this issue three distinct patterns of rosette which cover some novel and useful features. In the plain pattern Cartwright porcelain rosette and the ornamental pattern of the same, the brass connectors to which the wires are fastened have a slight projection from the base underneath the overhanging screw-head, opposite the point where the wire rests when it is clamped. The object of this projection is to prevent undue torsion of the screw when it is turned firmly down to clamp the wire. When there is no such support there is a tendency to throw the screw-head out of plumb and damage the connection, whereas when the screw head is equally supported on both sides, on one by the wire itself and on the other by the projection, better results are obtained.

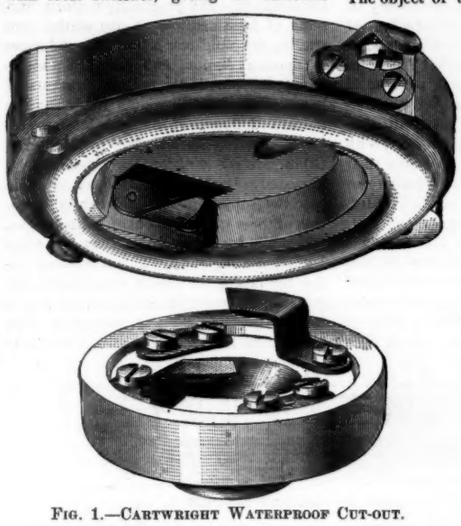


FIG. 1.—CARTWRIGHT WATERPROOF CUT-OUT.

In the Cartwright waterproof cut-out, which is controlled by The E. S. Greeley & Company, New York, this feature in the connector is not only present, but special stress is laid upon the fact that there are no screw-holes or metallic connections of any kind leading from the inside of this cut-out that might form contact with a damp ceiling. In fact, as the name implies, it is a waterproof cut-out. There is nothing specially novel about the manner in which the cap of this cut-out connects with the base, as several other cut-outs are made upon the same general principle, and while there is no criticism to be made upon the way in which the cap containing the fusible wire and the base interlocks automatically, the waterproof character of this cut-out is very highly commended.

FIG. 2.—CARTWRIGHT ORNAMENTAL PORCELAIN ROSETTE.

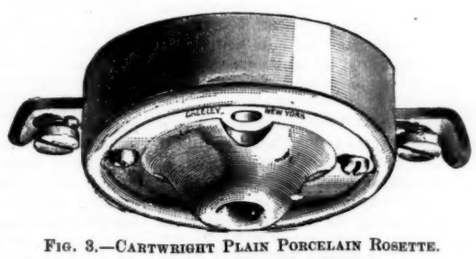


FIG. 3.—CARTWRIGHT PLAIN PORCELAIN ROSETTE.

Interior Wiring.

In the March issue of the "Journal of the Franklin Institute," appears an interesting article on "The System of House and Underground Wiring of the Interior Conduit and Insulation Company," by Mr. E. H. Johnson, the president of the company named. In opening his remarks, Mr. Johnson said:

"Briefly described, the system is nothing more or less than a well worked out scheme of supplanting or supplementing the former practice of attaching the insulation to the wire itself, by a system of insulated raceways, into which to draw the wires, and which supplies in itself a degree of high and durable insulation not attainable by the old methods, while supplying in addition the highly important (I might almost say imperative) adjuncts of accessibility."

Disk Clutch.

TO THE EDITOR OF ELECTRICAL REVIEW:

Your issue of March 14, page 58, illustrates the Dahl electric motor, showing as an element therein a "Disk" friction clutch.

As information for designers of such mechanism, but with no wish to detract from or even to express an opinion upon Mr. Dahl's combination, it may be well to state that the original English patent upon the disk or frictional portion of the said clutch, is No. 263, dated January 29, 1863, to T. A. Weston. The corresponding United States Patent did not issue until 1868, No. 75,227.

Such a disk clutch, compressed by a spiral spring or spiral springs, is shown in Weston's English patent, No. 1,373, of 1867, Figs. 1 and 4; also Fig. 17, plate 112, Proceedings of the Institution of Mechanical Eng'rs, November 5, 1868 (English).

T. A. WESTON.

Stamford, Ct., March 26.

ELECTRIC LIGHT NEWS

—— Chillicothe, O., wants electric lights.

—— President Linton, of the Ravenna, Ohio, Gas and Electric Light Company, is dead.

—— The Thomson-Houston Company has been awarded a contract by the city for lighting Parkersburg, W. Va.

—— The Edison Electric Illuminating Company, of Boston, has declared a semi-annual cash dividend of three per cent., payable April 1.

—— The Thomson-Houston International Electric Company has declared a dividend of $3.50 per share, payable April 15 to stock of record April 1.

—— Chief Webber, of the Boston fire department, has equipped his wagon with electric side lights, run from storage batteries carried beneath the seat.

—— The annual meeting of the Thomson-Houston Electric Company is called for Middletown, Conn., April 13, at 1.15 P. M. The books close April 6 to 13, inclusive.

—— The petition of the Merrimac Valley Street Railway Company, of Massachusetts, for permission to increase its stock from $80,000 to $250,000 in order to equip the road with electricity, has been granted by the railroad commissioners.

—— On March 2, 1891, the Consolidated City Line, of Kansas City, Mo., an electric railway connecting the two sides of the city, made its trial trip, which was in every way a successful one. The trip was made under direction of the Thomson-Houston Electric Company's representatives, which firm furnished all the electrical equipment of the new road. The object of this road is patent at a glance over its route. It connects with the great elevated system and the Grand View line, and passes the doors of many great manufacturing plants employing thousands of men, who will gladly avail themselves of the cheap and rapid transit afforded by the new electric line.

Marlborough Hotel Electric Light Plant.

This plant, which was recently illustrated and described in the ELECTRICAL REVIEW, is one of the handsomest in the city and has proved to be a feather in the cap of Maccabe Brothers, 321 West 145th street, New York, who installed it. The excellent work done by this firm at the Marlborough and the prominence given to it by the REVIEW, has resulted in their securing several other contracts of considerable magnitude.

Making Boston Pay for Electric Wire Accidents.

An interesting case, probably the first in which an attempt has been made to hold the city liable for accidents caused by electric wires, was disposed of, temporarily at least, in the Superior Court, before Judge Dunbar, Boston, one day last week. The plaintiffs are Joseph Graham, John Harkins, James McGonnagle, and John McGonnagle, who seek to recover damages for injuries caused by an electric wire. On October 7, 1889, the plaintiffs, who are small boys, were playing in Charlestown. One of them grabbed a live wire lying across the street, and he was soon joined by his companions, who, not aware of the danger, endeavored to take the wire away.

All four were held to the wire until the arrival of a policeman, who broke it with his billy. The city contended that the boys were not "travelers" within the meaning of the law, by reason of their stopping to play tag. Judge Dunbar allowed the case to go to the jury, with the understanding that if the Supreme Court decides that the boys were "travelers" the city shall pay them as follows: Joseph Graham and John Harkins, $3,500 each; James McGonnagle, $3,000, and John McGonnagle, $1,500.

Telephonic News

*** The telephone service at Albany, N. Y., recently prostrated by a fire, is once more restored.

*** The New England Telephone and Telegraph Company is constructing a line from South Framingham to Woonsocket, through Holliston, Milford, Mendon and Uxbridge, Mass.

*** The Bell telephone output for the month ending March 20, 1891, was as follows:

	1891.	1890.	Inc.	Dec.
Gross Output	5,717	5,179	538	....
Returned	3,167	1,648	1,519	...
Net	2,550	3,531	.....	981
Since Dec. 20:				
Gross	15,954	12,819	3,135	...
Returned	9,561	6,150	3,411	....
Net	6,393	6,669	.....	276

*** The directors of the Erie Telegragph and Telephone Company, it is reported from Lowell, Mass., have under consideration a proposition to sell a portion or all of their 70 per cent. interest in the stock of the Southwestern Telegraph and Telephone Company for $700,000, which is equivalent to $50 per share for Erie stock.

*** The New England Telephone and Telegraph Company deny that they owned a "dead" wire which crossed an electric light wire in Boston recently and shocked several boys. Damage suits against the telephone company have been brought, nevertheless. The case promises unusual interest, as full discussion of the ownership in and responsibility for "dead" wires and "crossed" wires will doubtless be its prominent feature.

*** London and Paris have at last been connected by telephone, and conversation has been carried on with perfect success between the two cities. There never was any great doubt that this could be done. The possibilities of the telephone are scarcely limited, except by questions of cost, and when the expiration of patent rights has given freer play to the invention and introduction of new forms of phones, the service will be greatly improved. The telephone between London and Paris will be a great convenience to bankers and large merchants, just as the long-distance telephone is to the bankers and merchants of Philadelphia, New York and Boston.—*Philadelphia Ledger.*

PERSONAL.

Mr. Herman W. Grannis, of the Railway Department of the Westinghouse Electric and Manufacturing Company's New York office, recently delivered an interesting address on electric railways before the Board of Trade of Jersey City, N. J.

Congressman Allen C. Durborow, Jr., business manager of the *Western Electrician*, Chicago, was a New York visitor last week, and paid the REVIEW a pleasant call. Mr. Durborow for the next two years will represent a Chicago constituency in Congress, but at the same time will continue his interest in electricity.

Iron Poles for Electric Work.

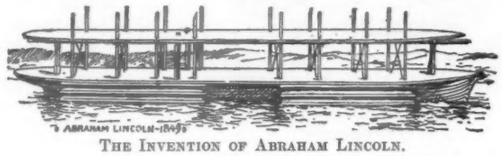
Messrs. Milliken Bros., New York, report a large demand for their patent street railway and electric light poles, which they are now furnishing to almost every section of the country. Several orders have been received from Colorado. The large and increasing demand for these poles shows beyond doubt their superiority for the work which they are designed. They have their large shops now completed with special machinery for turning out this class of work and are able to fill orders promptly, either from stock on hand or at short notice. Among the recent orders which they have secured are the iron poles to be used for all the street railway work at Pittsfield, Mass. The street on which these poles are to be used is unusually wide, and, consequently, the strain on the poles is very great, and after a careful study the road found it to its advantage to use the Milliken pole. This firm has now a very handsomely illustrated catalogue showing the different forms of poles which they make and their advantages.

Abraham Lincoln as an Inventor.

Mr. Edward T. Fenwick, patent attorney, of Washington, D. C., sends us the following:

Now that the Patent Centennial Celebration, to be held in Washington, April 8 to 10, is so close at hand, and inventors and manufacturers from all parts of the country are manifesting the greatest possible interest in the event, and so much is being said and written about the Centennial, the history of the patent system and the patent office, of famous inventors and curious patents, it might be interesting to know that Abraham Lincoln was an inventor and received a patent on the 22d day of May, 1849, numbered 6,369, for an improved means of combining adjustable buoyant air chambers with steamboats or other vessels to enable their draft to be readily lessened to permit them to pass over bars or through shallow water, without discharging their cargoes.

These adjustable buoyant air chambers were secured to the sides of the vessel (which in this instance was an old style Ohio steamboat), and were formed with top and bottom portions composed of a plank or plate of metal of suitable stiffness, and with flexible



THE INVENTION OF ABRAHAM LINCOLN.

side portions of india rubber, or textile material thoroughly water-proofed. These buoyant air chambers were very similar in construction and operation to an accordion or a blacksmith's bellows. The vessel was also supplied with a main shaft or shafts and with sliding spars or shafts, the latter passing down through the buoyant chambers and made fast to their bottoms; also with a series of ropes and pulleys, whereby, by turning the main shaft or shafts in one direction, the buoyant air chambers would be forced downward into the water and at the same time expanded and filled with air for buoying up the vessel by the displacement of the water; and by turning the shaft or shafts in an opposite direction, the chambers would be contracted into a small space and secured against injury.

It is also stated that President Lincoln was the inventor of the very ingenious method of emptying boats of water when they had become so filled that bailing was necessary. He bored a hole in the bottom of the boat and by heading the boat up stream in an opposite direction to that in which the tide was moving, a suction was formed which very quickly drew out the water through the opening bored in the bottom of the boat.

Mica.

With the extraordinary growth of the electrical industry in the United States for a number of years past, there has been created a new and steady demand for mica, which, curiously, has failed to stimulate the mica mining industry; the most important mines, indeed, show a decided decrease in production during this time, and the business is now in a depressed condition. In the construction of dynamos, electric motors and other electrical appliances, mica is a very important element, valued on account of its flexibility and excellent insulating qualities. For this purpose, however, there is a decided preference for foreign mica, the Canadian "amber mica" being generally used. The foreign mica is considered preferable to that of North Carolina for electrical purposes, in that while the latter can be split into thin sheets, it is by no means so tough. The chief mines in the country are in New Hampshire and North Carolina, but principally in the latter State, these producing an excellent quality of the mineral. The total value of the production in the United States decreased from $368,525 in 1884 to $70,000 in 1890. During the same time the imports of mica, which, prior to 1884, had been of but trifling importance, increased from $28,284 to $57,541.—*Engineering and Mining Journal.*

Recent Patent Office Decisions.

An important decision has been rendered by the Commissioner of Patents in an interference contest between Marcel Deprez & Jules Carpentier, Alexander Bernstein, Rudolph M. Hunter and Gaulard & Gibbs, the subject matter of controversy being the improvement in the art of transmitting the electrical energy to and utilizing it at a distance from the source, consisting in generating maintained and practically uniform currents of high tension at one station and sending the same over a line of conductors to another station, and generating maintained and practically uniform currents of lower tension at the second station by the inductive influence of the high tension currents. Priority is awarded to Gaulard & Gibbs. In his decision the Commissioner discussed several references alleged to anticipate the subject matter claimed as novel. One of these was the patent of Louis Maiche, which was for a telegraph system using two induction coils, one at the transmitting station for raising the tension of a battery current and the other at the receiving station for transforming the line current of high tension into low tension quantity currents to operate the receiving mechanism. In regard to this patent the Commissioner endorses the position taken by the examiners-in-chief, who held:

"The merit of applicants' device may be thus summed up: They generate high tension currents of alternating polarity directly, thus getting a high tension line current, with moderate sized conductors, capable of acting upon the induction apparatus without the interposition of any theotomes, commutators or other devices for wasting energy and destroying plant. This they translate directly into the low tension currents required, without the use of power or any apparatus except the local inductoriums. The changes over existing devices may seem simple and obvious after the fact; but this is a charge often brought against the most meritorious inventions, the telegraph and the speaking telephone not being exceptions. In the two latter conspicuous instances the courts have so far found invention in the light of the vastly important results, and we do not hesitate to find invention in this case."

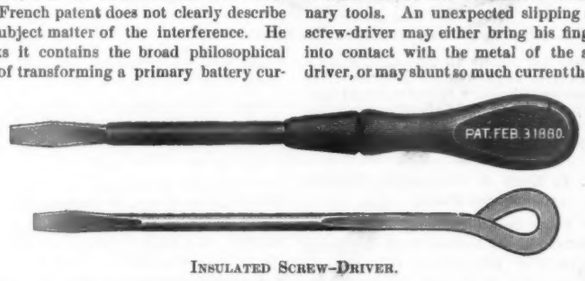
Deprez & Carpentier base their claim to priority upon a French patent granted them in 1881, but the Commissioner holds that said French patent does not clearly describe the subject matter of the interference. He thinks it contains the broad philosophical idea of transforming a primary battery current of low tension into a line current of high tension, and again transforming that current of high tension into one of greater quantity and less tension, but denies that it discloses or describes the practical method of electrical distribution dependent upon a line current of alternate and equal positive and negative potential directly generated. With regard to the Hunter claims to the invention, by reason of the making of drawings in July, 1881, the case was decided against Hunter by reason of a failure to reduce the invention to practice, the Commissioner holding that the construction of a certain telephonic apparatus alleged to involve the invention did not involve the exercise of the method embodied in the claim in the controversy.

Another decision was rendered in the interference contest between Wm. Stanley, Jr., and M. M. M. Slattery, for improvement in an alternating current system of distribution, involving the arrangement of converters in multiple arc relation to the supply conductors, each converter being wound with a primary coil of such length that when its secondary or supply circuit is open the electrical pressure and counter pressure in the primary circuit shall be equal, the advantage of such a system being that when no lamps or other translating devices fed by the secondary circuits are in use the transformers will act as choke coils and prevent any waste of energy. A patent for such a system was granted to Mr. Slattery July 31, 1888, and the interfering application of Mr. Stanley was filed August 15, 1888. The ground for the decision is that Stanley had a system involving the features of the invention in use at Great Barrington in March, 1886, the system comprising an alternating current dynamo and seven converters connected to the mains in multiple arc, these converters feeding a dozen or more consumers, whereas Slattery did not conceive the invention prior to June, 1886.

A decisive question of the controversy seemed to be whether the apparatus, as intelligently constructed by Stanley, did or did not contain the limitation of having a primary coil contain such length of wire exposed to the magneto induction of the transformer that the opposed pressures were equal when the secondaries were open, it being contented that inasmuch as the seven converters used in the Great Barrington plant upon which Stanley relied contained lengths of active wire in their primaries varying from 292 to 625 feet, and inasmuch as the several conductors were of substantially the same construction, apart from the matter of length, that the determining feature of the inventention could not have been in Stanley's mind; in the judgment of the Commissioner the shortest length of wire used was sufficient to create a counter-electromotive force substantially equal to the applied electromotive force when the secondaries were open, and that, therefore, the apparatus used at Great Barrington was within the terms of the interference. The Commissioner raised a question as to Stanley's right to a patent on account of more than two years' public use before his application, by reason of Stanley's claim to have tested the invention at Pittsburgh in September, 1885, and instructed the examiner to consider the claims also in connection with descriptions by Rankin, Kennedy and Zipernowsky & Deri.

A New Insulated Screw-Driver.

Every station man knows how risky it is to work around live conductors with ordinary tools. An unexpected slipping of the screw-driver may either bring his finger up into contact with the metal of the screw-driver, or may shunt so much current through the metal as to burn the tip of it. To say the least, these occasional shocks and short circuits do not inspire the workman with the confidence which he ought to have when making some delicate adjustment. For this reason, a screw-driver, which has all but the very tip well insulated, has been in great demand. Of course, the ordinary wooden handle gives a fair insulation, but it leaves the long metal shank exposed, thus being out of all comparison with the insulated screw-driver which we illustrate to-day. This consists simply of a steel rod, which is bent and flattened as shown, and which is molded into the insulating handle. Vulcanized rubber is the medium used, since it combines the highest and most lasting insulation with the toughness needed in a protecting handle. It is certainly hard to conceive of any simpler or better way of making a screw-driver for use when working around live circuits. It is made in a number of sizes, and is being pushed in the West by George Cutter, of Chicago.



INSULATED SCREW-DRIVER.

Interference With Alternating Currents.

A paper on "Interference with Alternating Currents," by Prof. W. E. Ayrton, F.R.S., and S. Sumpner, was read by the latter before the British Physical Society on March 6. The paper relates to the phenomena which occur when alternating electric pressures are impressed on circuits made up of various combinations of resistances, condensers, arcs and inductive coils; to the characteristics of alternators, to the properties of transformers and to the peculiarities exhibited by the Ferranti mains. In one of the experiments an inductive coil and a condenser were connected in series, and a pressure of 25 volts, as measured by a Cardew voltmeter, impressed on its terminals; the pressures on the two parts, measured in the same way, were 110 and 104 volts, respectively, thus showing that each of the two parts was much greater than the whole. On joining a condenser and inductive coil in parallel, an ammeter in the main circuit indicated 5.5 amperes, whilst those in the branches showed 6.4 amperes passing through the condenser and 10 amperes through the coil. Other experiments of a similar nature were described, and it was pointed out that the ratio of the sum of the two parts to the measured total may be large, being about eight in the case first mentioned. Theoretically, this ratio might be anything, depending as it does on the phases of the pressures in the two parts, and these phases are determined by the ratio of the impedance of the coil to its resistance; practically, however, it was not easy to get a coil of large self-induction and very small resistance.

Alternate current arcs and condensers give results of the same general character as those above described, as also do arcs and inductive coils, such as the regulating coils of lamps; this may cause considerable error in estimating the power supplied to such lamps. The magnitude of the error was found to depend greatly on the quality of the carbons and the character of the arc. With bad carbons and a hissing arc the error was very great, but with good cored carbons burning steadily, it was not very serious.

Combinations of inductive and non-inductive coils exhibit marked peculiarities, particularly if the inductor one be a transformer coil. This last arrangement gave distinct evidence of interference or difference of phase when the secondary of the transformer was open, but when closed and with a moderate load, the difference of phase disappeared, thus showing that under these circumstances the primary coil had no appreciable self-induction.

On the subject of alternator characteristics, a graphical method of drawing the E. M. F. curve from the terminal curve was described, and the dependence of the terminal curves on the character of the external circuit pointed out. Keeping the speed, exciting current, and armature current constant, the pressure between the terminals was shown to be dependent on whether the external circuit consisted of condensers, resistances or inductive coils, the pressure being greatest in the former case and least in the latter. The true E. M. F. of the dynamo, however, was the same in all the cases, but it became less as the armature current increased. From these results the authors conclude that the drop in E. M. F. with large currents is due to reaction on the field, but that the change of terminal pressure cannot be all attributed to this cause.

Transformers, it was shown, are powerful controllers of phase, for the primary and secondary currents are nearly always circulating in opposite senses, the phase angle for a 1 to 1 Mordey transformer experimented on, varying from 170 degrees at no load to 180 degrees at full load. The relation between the strengths of the primary and secondary currents, A_p and A_s was found to be a linear one, of the form

$$\frac{P}{S} A_p = \alpha + \beta A_p$$

where P and S are the number of turns in the primary and secondary, respectively, and α and β constants; α representing the exciting current and β being nearly unity. The phase angle ϕ between the currents was given by the equation

$$-\cos\phi = \frac{1+\beta^2}{2} A_s + \alpha\beta$$

$$\beta A_s + \alpha$$

The results of numerous experiments on a transformer of the Mordey type, in which coils having different numbers of turns were put in parallel with each other, were given. In some cases resistances were put in circuit with the coils, and in others one or more of these resistances were cut out. Remarkable interference effects were thus produced, for in some combinations the volts or currents were additive, whilst in others they were nearly differential. In connection with the Ferranti effect, experiments had been made by putting a condenser on the terminals of the secondary of a transformer, and noting the resulting increases in pressure, both in the primary and secondary circuits. The results obtained with a given condenser, and approximately constant secondary pressure, show:

1st. That whether the transformation be up or down, the percentage rise in the secondary is greater than that in the primary.

2d. That these percentage rises diminish as the secondary current increases.

3d. That they increase with the ratio of transformation.

4th. That the rise in the secondary may be considerable without that in the primary being appreciable.

5th. That the rise in the secondary still persists, even when large currents are flowing.

These facts lead the authors to believe that the "Ferranti effect" is due to some kind of interaction between the cable condenser and the self-induction of the transformer, and that is not wholly due to armature reactions in the dynamo.

In the discussion which followed the reading of the paper, Mr. Blakesley gave the following formula as applying to transformer currents generally:

$$\left(\frac{A_p}{A_s}\right)^2 = \frac{n^2}{m^2}\left\{(1+kr_2^2)+\frac{q\,r^2}{v}\right\}$$

where r^2 = resistance of secondary, v is proportional to the frequency, m and n the primary and secondary terms, and k and q are constants depending on the disposition of the iron. This formula he found to very nearly represent Ferrari's results, and he hoped others would test its applicability to various types of transformers. He believed himself to be the first who carried out an interference experiment, when he put a condenser in parallel with an inductive coil six years ago. He mentioned the matter now because that arrangement had been put forward by Mr. Glazebrook in explanation of the "Ferranti effect." Mr. Glazebrook, however, had made an error in stating that under certain conditions one of the currents may become infinite.

Mr. Swinburne said the character of the "Ferranti effect" had been wrongly stated, for he understood Professor Ayrton to say that the pressure between the Ferranti mains was greater at the London end than at Deptford. This, he contended, was impossible. He also said the effects now described of putting a condenser on the secondary of a transformer, and noticing the rise in both primary and secondary volts, were due to the waste field of the transformer. In large transformers, such as those at Deptford, the magnetic leakage was proportionately much less, and no such effects would be noticeable with them. Referring to the relation between the primary and secondary currents in transformers, he said it was convenient to look at the primary from two points of view, and consider one part of it as producing the magnetization and the other as neutralizing the effect of the secondary current.

Professor Ayrton pointed out that the measurements on the rise of volts by putting on condensers, mentioned in the paper, were not strictly analogous to those made by Mr. Ferranti, for his were made by pilot transformers, one placed between the primary terminals of the Deptford transformer, and the other on the secondary of the London transformer; whereas, in the cases now brought forward, the volts measured were those at the primary and secondary of the same transformer. On the subject of arc lamps, he said Messrs. Kolkhorst, Thornton and Wee'rs, who made the experiments, found that great lag only occurred when the carbons were bad and the arc hissing. If the apparent and the true power spent in such an arc were measured, a great difference existed between them. Dr. Hopkinson, he said, had shown that this might be expected if the arc had a constant back E. M. F. which changed sign with the direction of the current.

The Giles Automatic Thermostats.

These thermostats are founded upon the well-known principle of difference in the expansion and contraction of metals. They are made from special grades of metals that, after separated tests, are found to produce the best results. They are free from the objections of all liquid thermostats, in that they will

FIG. 1.

not make contact when the floor or portion of the building where the thermostats are placed is jarred. They are nicely finished, and all contact points are made of platinum. These thermostats are being placed

FIG. 2.

on the market by the Central Electric Company, of Chicago.

Fig. 1 represents a closed circuit thermostat, which is adjusted by means of a screw on the right. It is made to adjust from 70 degrees to 170 degrees, and has one-half inch movement in 100 degrees.

Fig. 2 represents an open circuit thermostat, which is adjusted by means of a lever below the coil, and has an adjustment of 100 degrees above the temperature of the room when placed in position, and has one-half inch movement in 100 degrees. Fig. 3 represents side view of the thermostat.

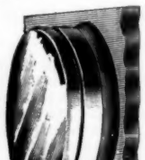


FIG. 3.

New Steam Engine Work.

Messrs W. R. Fleming & Company, New York agents for the Foundry and Machine Company, at Harrisburg, builders of "Ide" and "Ideal" engines, are doing an excellent class of work for steamships, etc., as well as in other lines of electric steam power work. They have just taken orders for engines for running dynamos on two of the United States government light-ships, on Staten Island, and also for the Pacific Mail Steamship Company. It is the "Ideal" self-oiling engine that gives such entire satisfaction on board vessels, on account of its ease in running, and perfect smoothness and evenness in governing, which makes it the model engine for steamship service. The engines for light-ships are to be from eight to ten horse-power, cylinders five inches to six inches, a neat sturdy little engine on a cast-iron foundation base, which takes up little space, but will do good work, if they are like all their predecessors of this type. Fleming & Company are starting up some three or four large plants in and around the city this week, which they have contracted for and built from the foundation up, start under steam, turning over to the owners in running order. They are building up a fine business in this line of work, and patrons are being educated to see the need of skilled and practical engineers to oversee the erection and building of steam plants for electric purposes, if they expect best results from their dynamos, as all does not depend on the dynamo.

TELEGRAPHIC

.... The House Committee in the Michigan legislature has reported favorably a bill reducing telegraph rates in that State 30 to 40 per cent.

.... The Western Union Telegraph Company has purchased the lines of the Columbus Southern Railroad in Georgia and has taken charge.

.... The Court of Claims will not hear the arguments in the suits of the Western Union Telegraph Company against the United States to recover "reasonable rates" for its telegraph service before October.

.... Lawrence, Mass., is the latest city to establish the office of Inspector of Wires. Under the ordinance, the official will have exclusive charge of all the fire-alarm telegraph apparatus and machinery in the city. The salary is $1,500.

.... Henry Winthrop Gray has been appointed receiver of the United Lines Telegraph Company by Judge Ingraham, of the Superior Court, New York, in a foreclosure suit brought by the Farmers' Loan and Trust Company. His bond is fixed at $25,000.

.... The New England Printing Telegraph Company has filed in the Supreme Judicial Court a petition for an injunction to restrain the aldermen of Birmingham, Conn., from voting to cancel or revoke the authority given to the company by the Board of 1890, to erect poles in the streets of the city. The bill is a long one, and after reciting the proceedings of last year's board in passing the order in question, it alleges that the petitioner has incurred great expense, relying on the order, and that its revocation would be a great injury to it. An order of notice in the matter is returnable April 7.

Suit Against John W. Mackay.

Judge Barrett, of the Supreme Court, last week directed John W. Mackay to submit to an examination before trial in a suit brought against him and Hector De Castro by Edward S. Stokes, to recover $75,000 alleged to be due on the purchase of certain telegraph stocks. Stokes claims that he owned bonds and stocks in the United Lines Telegraph, Chicago Board of Trade Telegraph, Pacific Telegraph, Pacific Mutual Telegraph and Lehigh Valley Telegraph Companies, and had contracts for the purchase of stock in other companies. He says Mackay agreed to purchase all these securities for $100,000; that Mackay paid him $25,000 on account, and that most of the securities were delivered to Mackay. Stokes maintains that the property was acquired for the joint benefit of himself and Mackay, Mackay having agreed to furnish the funds and he the labor in securing the property. He also alleges that Mackay authorized De Castro to make a contract with him and to apply for a transfer of these securities.

Mr. Mackay says that he advanced the money to Stokes to purchase the property, and that it belongs to him. Stokes denies this.

Ball & Wood Engine Company.

The Ball & Wood Engine Company, of 15 Cortlandt street, New York city, after careful consideration, have selected a factory site at Elizabethport, N. J. The site is admirably chosen because of its excellent situation on the Central Railroad of New Jersey, at the junction of the main line and Long Branch division. It adjoins the Singer Manufacturing Company's enormous plant, and is next to the Singer Park which is so beautifully kept. The Worthington Steam Pump Company have purchased a plot in the immediate vicinity, and contemplate erecting a fitting structure for the manufacture of their specialties. The Ball & Wood Company will build without loss of time, and they will put up a building which will not only serve their manufacturing purposes, but be as well architecturally interesting. They have shown good judgment in the selection of their factory site, for the advantages which the Central Railroad affords for traffic and shipping facilities are unexcelled.

KINDRED INTERESTS

The Evans Friction Cone Company, Boston, have recently received 12 orders for their dynamo driving device, and 33 orders for their well-known speed cones.

The Pettingell-Andrews Company, 192 to 202 Summer street, Boston, have just closed contracts with the electric railways of Springfield and Holyoke, Mass., for all the feed wire to be used by them. The orders aggregate about 15 miles of Shield brand 000 wire.

The Central Electric Company, Chicago, are about to place a new carbon battery upon the market, the principal features being the purity of the carbon and the shape of the glass jar, which fits so tightly to the carbon that it makes its virtually air-tight and thus prevents the evaporation of the solution.

R. T. White, 12 Pearl street, Boston, manufacturer of patented materials for street railway construction, has established the following agencies: W. D. Thomas, 141 Bryan street, Savannah, Ga.; D. E. Garrison & Company, Laclede Building, St. Louis, Mo.; and Great Western Electric Supply Company, 190 and 192 Fifth avenue, Chicago, Ill.

The Elaborate Habirshaw Wire Catalogue recently sent out by the Electrical Supply Company, of Chicago, is bearing good fruit. In this pamphlet the essential difference between so-called rubber insulation made of compositions and one made like Habirshaw of pure rubber is shown. Habirshaw has been put to the most severe tests on numberless occasions and we are informed that its first failure has yet to be reported. Many of the leading wiring contractors are using Habirshaw for their work.

WANTED.—A competent dynamo man; one who is familiar with the work of changing commutators and repairing armatures, and also with setting up, connecting and running of dynamos, etc. State age, experience and wages expected. Must come well recommended.

Address DYNAMO, P. O. Box 3311, Boston, Mass.

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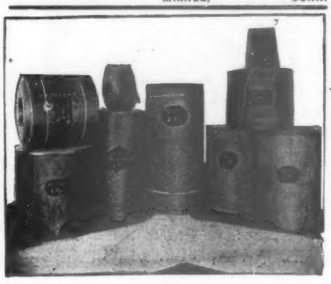

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One 41-Inch Three-Ply Electric Belt for CITIZENS' ELECTRIC ILLUMINATING CO., BROOKLYN, N. Y.
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THE LAW

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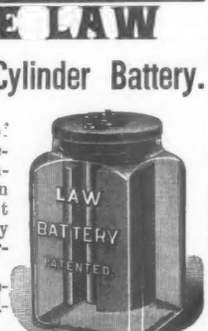

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PROPOSALS FOR ELECTRIC LIGHTING.

Notice is given that sealed bids are solicited for the lighting of the streets of the Borough of Asbury Park with seventy-five electric lamps of two-thousand candle-power, to BURN ALL NIGHT FROM JUNE 1 TO OCTOBER 1, and UNTIL 1 A. M. FROM OCTOBER 1 TO JUNE 1.

The contract to run for the period of five years, from June 15, A. D., 1891. The Borough to reserve the right to reject any or all bids, which must be presented on or before April 6, next, 12 o'clock, noon, when said bids shall be opened.

All bids must be accompanied by a certified check for $1,000 payable to the order of the Borough of Asbury Park as an evidence of good faith on the part of those making them and to be forfeited to the borough in case said contract is not performed by the firms or corporation to whom it is awarded. For map showing location of lights which shall be designated by the borough and for any other information, address F. L. TENBROECK or WILLIAM H. SMITH, of Asbury Park. Bids should be addressed to

C. T. BAILEY,
Clerk Board of Commissioners,
Asbury Park, N. J.

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON MARCH 24, 1891.

448,627 Telephonic auditory apparatus; Geo. V. Benjamin, Ithaca, N. Y.

448,653 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Co. of America, same place.

448,666 Dynamo-electric machine; Samuel E. Nutting, Chicago, Ill., assignor to the Nutting Electric Mfg. Co., same place.

448,669 Electric contact device; Frank A. Perrett, Brooklyn, N. Y., assignor to the Elektron Mfg. Co., same place.

448,676 448,677 449,002 449,003 Meter for alternating electric currents. 449,001 Method of measuring alternating electric currents; Oliver B. Shallenberger, Rochester, assignor, by mesne assignments, to the Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

448,679 Waterproof combined coupling and cut-out for electric circuits. 448,680 Connector for electric wires; Frank Shlauderman, Decatur, Ill.

448,681 Speed regulator for electric motors. 448,682 Adjustable rheostat. 448,840 Protecting motor mechanism of electric cars; Sidney H. Short, Cleveland, O., assignor to the Short Electric Railway Co., same place.

448,684 Fire alarm signal box; William F. Singer, Carthage, assignor to the Singer Fire Alarm Co. of Buffalo, Limited, Buffalo, N. Y.

448,698 Electric switch; Doulee B. Turner, Chicago, Ill.

448,703 Support for electric line wires; Herbert C. Wirt, Boston, Mass.

448,711 Overhead crossing appliance for electric railway; Isaiah H. Farnham, Wellesley, assignor to the New England Telephone and Telegraph Co., Boston, Mass.

448,712 Electric time alarm; John J. Gallagher, St. Louis, Mo.

448,726 Telephone transmitter; Thorstein Oeyan, Christiania, Norway.

448,741 Cover for incandescent lamps; Emil T. Mueller, La Crosse, Wis.

448,743 Electric heater for dental vulcanizers; Jeremiah O'Meara, New York, N. Y.

448,751 Railway circuit for signaling and controlling trains; Frank E. Kinsman, Plainfield, N. J.

448,778 Electric railway; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.

448,779 Telegraph. 448,781 Turning off device for phonographs; Thos. A. Edison, Llewellyn Park, N. J.

448,780 Device for turning off phonogram blanks; Thos A. Edison, Llewellyn Park, N. J., assignor to the Edison Phonograph Co. of New Jersey.

448,782 Electric lighting; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Co. of Connecticut.

448,786 Brace for telegraph poles; Henry Ogden, Fall River, Mass., assignor of one-half to James H. Ogden, same place.

448,792 Electrical indicator; Chas. Wirt, New York, N. Y.

448,798 Galvanic battery; Chas. J. Hirlimann, Fort Lee, N. J.

448,831 Trolley for electric railways; Rudolf Eickemeyer, Yonkers, N. Y.

448,838 Insulator for electrical conductors for mines; Francis A. Pocock, Scranton, Pa., assignor of two-thirds to Elmer H. Lawall and Rufus J. Foster, both of same place.

448,847 Clamp for electric battery zincs; James H. Leakin, Baltimore, Md.

448,856 Electric signaling apparatus for railways; Edwin D. Graff, New York, N. Y.

448,865 Lamp for electric railway cars; Chas. G. Smith, Brooklyn, N. Y., and Louis Pfingst, Boston, Mass.

448,879 Electric heating apparatus; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.

448,894 Electric meter; Elihu Thomson, Swampscott, Mass., assignor to the Thomson-Houston Electric Co. of Connecticut.

448,910 Electric street car driving gear; Conrad M. Conradson, Madison, Wis.

448,914 Filament for incandescent electric lamps; Georg Eriwein and Friederich G. A. Heller, Berlin, Germany, assignors to Siemens & Halske, same place.

448,915 448,916 Filament for incandescent electric lamps; Georg Eriwein, Berlin, Germany, assignor to Siemens & Halske, same place.

448,920 Filament for incandescent electric lamps; Friederich G. A. Heller, Berlin, Germany, assignor to Siemens & Halske, same place.

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